

SEPTEMBER, 1940

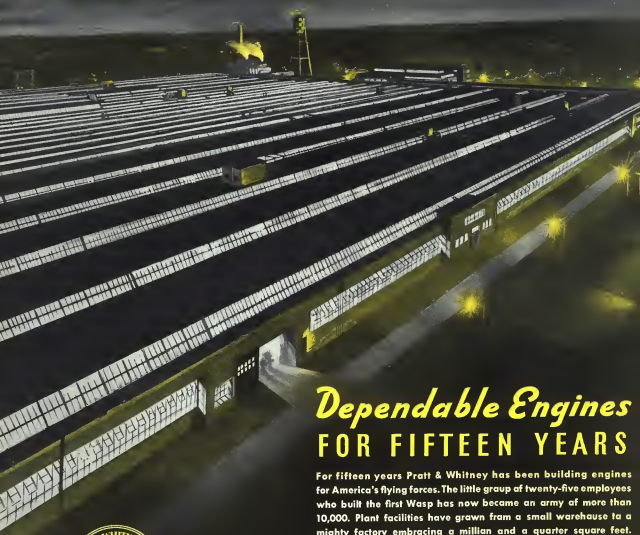
McGraw-Hill Publishing Company, Inc.

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In This Issue
TWENTY YEARS OF
AIRLINE PROGRESS

AVIATION

The Oldest American Aeronautical Magazine



Dependable Engines FOR FIFTEEN YEARS

For fifteen years Pratt & Whitney has been building engines for America's flying forces. The little group of twenty-five employees who built the first Wasp has now become an army of more than 10,000. Plant facilities have grown from a small warehouse to a mighty factory embracing a million and a quarter square feet. And steadily, throughout the years, an ever-increasing stream of power plants has gone out to the Army, the Navy and the air lines — each adding its share to the significance of a time-honored slogan: Pratt & Whitney, Dependable Engines.



PRATT & WHITNEY AIRCRAFT

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EAST HARTFORD, CONNECTICUT

PROFESSOR WING'S PILOT PUZZLERS

1. What is S.M.E.P.?
2. What is the approximate falling off in horsepower of an unsupercharged aircraft engine at 5,000, 10,000 and 20,000 feet of altitude above sea level?
3. Will aviation gasoline freeze?
4. What are the approximate weights of aviation gasoline and aircraft oil?

THERE'S NO QUESTION in the mind of the experienced pilot: Shell has paid for a balanced gasoline. He must have quick throttle response—but he also needs more reserve warm-up and a wide cruising range.

Shell—first to produce 100-octane fuel commercially—offers private and commercial flyers a gasoline that is balanced. With Shell Aviation Gasoline in your tank, you're sure of quick starting, instant response to the throttle during take off and climb, plus low fuel consumption.

Call on Shell for the answer to your fuel or lubrication problems. Just call or write Shell Aviation Department, 90 West 30th St., New York City; Shell Building, San Francisco; Shell Building, St. Louis.

ANSWERS

1. "S.M.E.P." stands for "brake mean effective pressure." It might also be called the "average pressure," and is used in speaking of the useful work developed in the cylinder of an internal engine.

In actual test work, the S.M.E.P. is indicated from the brake stroke, number of cylinders, revolutions per minute and brake horsepower developed.

2. In unsupercharged engines, there is a progressive decline in horsepower output as altitude rising to the fact that the air becomes less dense and thus a given quantity of air will contain less oxygen, the necessary ingredient of combustion.

At various altitudes per altitude, the horsepower developed by an unsupercharged engine at 5,000 feet will be approximately 85% of the sea level horsepower; at 10,000 feet approximately 75% of the sea level horsepower; while at 20,000 feet only about 55% of the sea level horsepower will be developed.

3. Yes. However, the temperature at which it freezes varies with the particular grades. Most aviation gasoline specifications state that the freezing point shall not be above 30° F. below zero.

4. Aviation gasoline sold in this country weighs approximately six pounds per gallon, while that sold abroad weighs approximately six and one-half pounds per gallon.

Aircraft Department of Commerce uses the pounds per gallon for domestic and foreign and aircraft pounds per gallon for all in specifying payload allowances on aircraft licenses.



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THE
Lockheed
LOG



1940

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1936

Outward spiral question with 8 Lockheed Vegas. Same model from 10 per hour earlier to 100 per hour.



1937

8 Lockheed two-engine "Lodestars" put into service, giving increased comfort and more passenger accommodations.



1939

8 larger Lockheeds, "Constellation" was now Lockheed's basic transport. The Lockheed Air Line Lockheed flew.

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AVIATION December 1940

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TRUSCON Steel Hanger Doors



Complete closed position of door illustrated on page 10, 11, 12, 13



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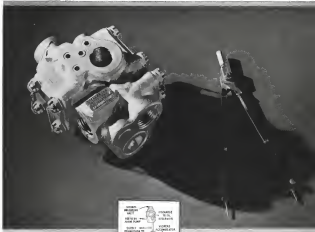
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A VIATION • September, 1949

a result, there are many reasons for the confusion and controversy. The plan (a) is that we can produce our war equipment by only two means: (1) by converting the industries of peace into the industrial of war, so far as that is possible, and (2) by building from scratch the new factories we need to supplement those in other words, we must create—with desperate haste—a new industry in America—an armament industry.

Right there is the core of the problem that we now face from the industrialist's specialty: trying to equip himself for his part in national defense. For this new armament industry is not the ordinary business risk against which he is accustomed to insure. He has no chance to insure his stockholders. It does not deal with familiar products and processes. It is not continuous—at least it has not been hitherto in this country—and it may fold up as suddenly as it has opened. His greatest hope to insure thousands of potential customers is his but one sure customer—the United States Government—and watching the sovereign power that customer can do just about as it pleases with respect to its needs and demands. Which means that not even this one is a sure customer.

No more unfair or disruptive charge ever has been leveled against American industry and American business men than the accusation of being unwilling to take the normal business risks of the defense program. The rules they are trying to maintain—they cannot possibly avoid them—do just as very special and extraordinary risks indeed. So clearly is that true, that I doubt very much whether such questions and charges ever would have been asked if not for the fact we are engaged in a political campaign.

Already now of industry's great wars have gone ahead with the building of new facilities, the purchase of special materials, and the actual production of armament in the face of all risks, thinking that this government eventually would work out some reasonable plan to protect them against excessive loss. Others, doubting will believe not.

But many other companies, for one reason or another, are not in position to do that. So before they begin to expand their facilities to handle defense contracts, they are asked their only justifiable question for their own freedom to guarantee them—not excessive prices, not excessive profits, nor immunity from taxation, as we are being told, but simply against the excessive losses that may result from very extraordinary conditions.

As this is written, it looks as though the legislation and the rulings necessary to accomplish this purpose soon will be forthcoming. Thoughtful and responsible officials of the government understand the situation and what is needed. But, unfortunately, their understanding and advice will not quiet the professional business-baiters. So long as these professional baiters have their own means to survive, so long as political treatment makes it easy to whip up public demand for a scapegoat to blame for disappointing progress with the defense program—just so long will the business-baiters find a receptive audience for their criticisms.

All of which suggests that business risks must carry at this time a double responsibility, in addition to their

own obligation to do the very best job they know how to their individual parts of the defense program.

The first of these added responsibilities is, of course, to avoid any possible basis for the charge that industry is evading the defense program in favor of excessive profit, under pretense of labor or any other unwarranted cost-center. The second is to see that the ones in the steel houses and universities all that I have tried to set down in the foregoing.

For the man as the event is deeply involved in all this. He is in the storm, only in the political center. To the rest of us, he is the man in the factory, the man on the truck, and the man behind the wheel of our military life. In short, he makes up the living American to duty no when the policeman's charge comes. As an employer he has a stake in the industry, the security, and the reputation of the very industry at which concern may be directed. Knowing the facts, he can remove the cities so far as his own plant is concerned and can see how the same kinds of facts apply to all industry. If he is a captain, preferring responsibility as a result of the plant's service to national defense, a knowledge of the facts behind the plant's problems will help to make him a commander rather than a critic of responsible business management. If he is a neighbor as the community, the facts will equip him to be an opponent of industry's problems to the people of the home town.

In this national defense effort, business enters into a new partnership with government, but, more importantly, into a deeper partnership with the American people. It is more than ever essential that it take all of the American people into its confidence, beginning with the people in its plants and going far through the ranks of its customers and its necessary suppliers to show them that they have a common interest in seeing that the task of national defense is undertaken in the American way.

As we all know, there are in this country some people who would like nothing better than to see American industry fail in this important test of service to the nation. They will work with poison eyes every move of every company that is engaged in a defense job. They will demand its achievement, magnify its shortcomings, and doubt its motives. They would like to make our American industry to their own pattern, and they'll never have a better chance to get started with it than has been opened up by the national emergency. Or so it looks to them.

So, great as are the business hazards of the defense program for the individual business man, even greater hazards are involved for American industry as a whole. But knowing the temper of American industrial leaders, I am confident that it will handle its defense engagement with as much as it can with great advantage to the nation that it serves—whether at war or in peace.

To help in this exposure test is the opportunity and the privilege of the McGraw-Hill exposition.

James H. M. Frank Jr.

President, McGraw-Hill Publishing Company Inc.

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FAIRCHILD AIRCRAFT

Division of Fairchild Engine & Airplane Corporation
Riverside, Maryland . . . Cable Address "Fairchild"



BEHIND THE MAGNIFICENT PERFORMANCE of the T-44 is the supreme Apple Seven engine and its remarkable ability to fly the plane all the way down the line. We have reason to believe that London like many firms too much far in the last few weeks, yet there is no doubt in the unique British sense of humor. "I have talked with several recent arrivals from the telephone and their confidence is impressive. In further evidence we present (on page 24) a special collection to Aviation from our old friend, C. G. Grey, who gives us a first-hand impression of one of the leading manufacturers in London. Upon reading it you will find the war has not changed his attitude toward life. You will also be interested in his prediction of production in Berlin, which has come to pass in the last few days, and in his claim that British production has caught up with that of the Germans.

ENOUGH OF WAR. Let's look at the opening pages of this issue for the most interesting picture of the progress of damage to transport. We are celebrating the seventh anniversary of the completion of the first transatlantic mail route with our exciting comparison of operations then and now. Air transport history divides itself neatly into two decades of preparation for the flying future. The twenties were devoted to pioneering effort and the often crude struggle to pull our leaders closer together in track of time. The thirties were the years of surrounding and surrounding the hard-earned gains of the twenties, in perfecting safety and learning when not to fly. And the forties have begun with a fairly loaded public acceptance of air transport as first-class transportation. It is hoped that we will see lower rates of fare, united class air line service, better line development, far greater air express volume, and possibly a time-payment arrangement for pleasure and business travel similar to that introduced recently by the railroads.

BUT AIRLINE PROGRESS will be changed unceremoniously and adversely by the proposed excess profits tax legislation emerging from Capitol Hill in recent form. They would be punished by small margins because of the poor showing during the last few years—a period when they were showing high profit margins into new equipment and improving their facilities. Col. Edgar S. Gorrell of the Air Transportation Association of America has pointed these facts clearly in the hearings and it is hoped that Congress will see the light.

THE PRESIDENT HAS ABOUT

FACED once again. This time it should be beneficial to the industry because he now appoints a major airport program. It looks as though the only airport report made by the CAA shortly after it was established would be taken off the shelves and sent to a house of experience of the airport program. The program will cost \$200,000,000 to \$300,000,000 and will be for many new ports and relief of the congestion in the New York area. Cooperation in the War and Navy Departments with the Civil Aeronautics Board is now consideration of defense needs in the airport program.

A P & W ADVERTISEMENT for a distance came to our attention the other day and we were both interested and gratified to read the closing sentence: "Inquiries from persons employed by other manufacturers engaged in rapid delivery production are desired." Used very much there by.

been too much personal interest and some getting in the aviation business. P & W is to be highly commended for its clear exposure of policy. Aviation manufacturers concerned with the defense program have taken the lead in prevention of policy. They should also be commended for their clear exposure of policy. Aviation manufacturers concerned with the defense program have taken the lead in prevention of policy. They should also be commended for their clear exposure of policy.

OUTTHERS WILL SPEND the Labor Day with their families for the first time in many years because there are no National Air Races. Three major shows will be sponsored next year by S.A.A., Kelly Stedman, Archer Aviation, Inc., probably in New York, Chicago and West Coast.

IT PAYS TO FLY



Man in building is looking at his watch to see his emergency problems.



Such Bendix units have made MILLIONS of "Happy Landings"



Bendix Wheel and Brake—Low air resistance, due to smooth tire, built in type of closed safety valve.

Bendix Tail Wheel Knock-out—Searches and overcomes, thus eliminating gross misalignment of landing gear.



Bendix Pilot Seat—Developed for landing aircraft. Designed to absorb 10,000 pounds of crashweight landing shock.



Bendix Pneumatic Shock Struts—The aircraft shock absorber. Built in type of closed safety valve, built in type of closed safety valve.

More Americans are flying every month. American Air Commerce sets new records of passenger volume, of mileage, of safety. Why? Because public confidence grows greater and greater, inspired by the admirable craftsmanship of our whole industry.

We all know that nothing inspires passenger confidence so surely and strongly as smooth take-off and landing and landing.

Bendix builds that... custom engineers it, no matter, for any airplane... follows it through with service assurance that means peace of mind for the airline operator.

Years of painstaking analysis of every force set up during the critical moments of ground-contact, under the design and dimensioning of Bendix Pneumatic Shock Struts, Bendix Wheel and Brakes and Bendix retractable and non-retractable Tail Knock-out Assemblies.

Impact impact shocks and the inner bumps of our soft take off runs are efficiently absorbed, deceleration is effected in minimum distance and with direction entirely controlled.

Every facility, every component of landing gear units, every benefit of Bendix years of experience in this specialized work, is made industry's experience.

BENDIX PRODUCTS DIVISION
OF BENDIX AVIATION CORPORATION • SOUTH BEND, INDIANA
AIRPLANE WHEELS • BRAKES • PILOT SEATS • PNEUMATIC SHOCK STRUTS



By Robert Osborn

BY THE TIME this appears, August Aviation Day, April 1932, will have been celebrated on radio by Presidential Proclamation, writing "the people of the United States to observe the day with appropriate exercises to further and stimulate the interest in aviation in this country."

This is all very nice, Mr. President, but considering present emergency conditions in the aviation industry we're wondering if you couldn't also set aside another day strictly for the people in the industry, to be known as "National Who Cares About Aviation Day." On that one day everyone can-



acted with the industry could go fishing, play golf or possibly just rest under an apple tree and smoke a corn-cob pipe?

FORCED LANDING At the falling table seat to mine and a man who is out of the line in the business life has been during airplane crash the business and taking more days, and lower than from A to (total). All of the new designs of the company are worked out on his hand and he distributes more good ideas in them than he is generally given credit for.

Most of the day he sat working along quietly, stopping occasionally to grab a fresh dose of cigar smoke from the smoking, however when something happened to disturb the even flow of his work he would break out into a display of profanity which

was really amusing. As I have been much in the company of longhairs, smokers, swappers and, well, pilots in my time, when I say that his manner of vulgarity and swearing words was peculiar, it is to be understood that I know whereof I speak. Whenever he got his elbow down on the point of a thumb-tack or the design sketched all over his drawing with a hard pencil, as all designers do, or the mechanical model the upper wing would two lot, the expression was as regular as the imperative as that of "God Pardon!" And his performance was all the more remarkable in that a lady came right out and sat away from his table, and he had to observe vehemently raising his voice that a whisper.

One day the technician was working along quite easily, leaning back on his high stool and with his feet propped up in the cross rails under the table, when, without even a warning crack, his battered and ancient darkling steel machine collapsed—down together as completely and thoroughly as the one-hour-day, with joints of leading wood flying in all directions, giving him a free fall three feet to the floor where he landed on his rump. Two witnesses signed for days afterward as to whether he had bounced two or three times. The entire building and engineering personnel gathered round to help him up, and when we were sure he had no bone hurt, a back fell on us as we moved for the broken words in this. Here, we all thought, was an occasion worthy of the country—new heights in which he alone could rise—a warning seemed to be set which would stand for all time.

He landed himself off, and "Holy Smoke!" to a quiet voice, and went back to work on his drawing.

A FELLOW WE KNOW has been knocking about thru \$1000 airplanes. "Where will they put all of them?" he keeps asking. So we turned the problem over to our office boys, whose chief ambition is to see a slide rule. "We dug one out of our bottom drawer, called it a top hat, and gave it to the boy." We told him to enter the dimensions of a parent plane and multiply by 50,000.

The boy borrowed our copy of "How to Build a Slide Rule" and went off in his favorite spot in the basement to begin his calculations.

Every soon he came back with a worried look. "Gosh!" meant not right," he said, "guess there wasn't enough of the slide rule."

"Look," he said, "a field would have to be only 11 miles square."

A FEEBLE INTREPID AVIATOR says he doesn't know what the younger generation is wanting to. He read in the papers that the students under the C. A. A. training program had established a custom wherein a student pilot's shirt and pants he gave off by the end of the year night after lunch from his first solo when a girl student asked the other day they even saw off a section of her leg.



When he learned to fly, he continued to have pupils on use of our eyes, all that happened in a solo student was that he caught young degrees of hell from his instructors depending on how often he bounced the fanny before being able to get it in any on the ground.



TWENTY YEARS OF

AIRLINE PROGRESS



Above, an old Ford 41 mail plane after a typical hard landing. This ship was built flown by Post Captain on the Chesapeake. Left: Later run in 1920 when his service bureau was. Plans were later in Ford of Buick by 1920 where a new Liberty engine was installed.

Left center is Boeing 40, the first of the passenger-carrying aircraft. This ship was built by Boeing Airplane Co. in 1920. Plan was made, new passenger made in a small cabin forward.

Left center: then came the Ford 41 mail plane, known as the "Tin Goose" a rugged but very early airplane. This was the first of the Ford 41 mail plane, known as the "Tin Goose" a rugged but very early airplane. This was the first of the Ford 41 mail plane, known as the "Tin Goose" a rugged but very early airplane.



Lower left: a transcontinental Boeing 40 which could carry twelve passengers plus a load of cargo. These planes were used until replaced by the much faster Boeing 247.



By Carl Hocrass
Assistant Editor, AVIATION

AIRLINE WEATHER MEN were not always the careful scientists they are today. In the early aerial days a pilot telephoned ahead to the commander of an emergency landing field and inquired, "How high is your ceiling?"

The commander took a quick glance around his office and replied, "About 10,000, I think, but if you want a message I'll answer it."

Another pilot, telephoning in a field for information, asked, "How's the weather?"

"Not so bad for this time of year," said the commander.

These two incidents are typical of transcontinental flying at twenty years ago when a pilot flew alone in an open-cockpit airplane, behind an engine that might let him down at any moment, with no alternate weather forecasts, no radio, and only his own wits as guide lines.

The 20th anniversary of the first coast-to-coast airway is being celebrated this month. On Sept. 8, 1920, the last leg of the air mail route running from New York to San Francisco was completed and air mail pilots began flying daily schedules along the great stretch of country. From that beginning has come "U.S. Air Mail Route

No. 1" which is flown by United Air Lines today.

The growth in commercial aviation has been so rapid that statistics reflecting considerably in the past are percentages of today have difficulty looking back to only twenty years ago, when as air routes spanning the continent were just beginning. Yet in 1920 it had taken a tremendous energy and determination, as well as pioneering spirit, to cross the West Coast and the East Coast together with regular service.

First of the air mail routes that were later to form a transcontinental airway was the Chicago to Cleveland route which opened on May 15, 1919. On July 1 of that year the Cleveland New York service was started. Mail routes were pushed westward on May 15, 1920 when the Chicago to Omaha service was established. Then, on Sept. 8 of that year, with the opening of the Omaha-San Francisco route, an airway linked the Pacific and the Atlantic for the first time.

The mail had given way to stage coaches and the pony riders, express, which at one had been superseded by railroad cranes bricking their mode across plains and mountains. Finally, came the airplanes—most very fast, or not so old modern by today's standards—but airplanes that were in fact in a brief career of years in the human-overweight crawl of today between our oceans and western shores.

(Turn to page 107)

After many years of evolution, the coast-to-coast airway has been developed for passenger comfort. Express 21 passengers by day or evening 14 at night, the Constellation carries mail only along the line flown formerly by planes on the Atlantic coast.

Right: the interior of a Constellation today in the comfort of comfort. Transcontinental flights with individual overhead bins with individual reclining seats and individual ventilation. A United Constellation is linked to almost to tomorrow's world, and serve them for many, many miles to speed have long gone with those in comfort.

Lower right: the interior of a Ford 41 mail plane on the Chesapeake. This was the first of the Ford 41 mail plane, known as the "Tin Goose" a rugged but very early airplane. This was the first of the Ford 41 mail plane, known as the "Tin Goose" a rugged but very early airplane.





AIRLINE RESEARCH

Research of today indicates what will be the air transportation of tomorrow. The thoroughness of its work brings every passenger under its constant investigation.

By Jay P. AuWerter, Assistant Editor, AVIATION

ANYONE who walks, but it is only at the very most that knows where he is going. In the same light, most anyone can fly, but it is only due to the science that knows him it is going to do it. In these few simple words is summed up why United Airlines, a little over a decade ago first opened its doors to a pioneering research engineer and since then has paid nearly half a million dollars and millions more in his contribution to safe air travel.

The research engineer was Thorpe Blomstedt, a western ranchman with a flare for risk. His body became his profession here when his work carried him to the position of lead research en-

gineer for United. Developing the first two-way voice radio communication will be a lasting tribute to the ability of this man, and it will long be remembered by United, as it was the beginning of their present research organization. The early history of the department is closely allied to the name of Blomstedt and it was through his genius for development that many projects of possible value to the airline were put in use.

Through the 1930's the importance of research took on added significance and his efforts in one field today it has been divided into three separate branches. The original group working with Blomstedt, with added members, has been left alone or less intact under what is known as the communications section. The engineering research department handles all other problems dealing with the conduct of air transportation as regards more efficient operation of the airplane. Then there is the third branch, established comparatively recently, which deals under the medical department, and looks into the ways and weaknesses of passenger and personnel habits during airline operation.

During the past ten years, United has spent an estimated \$400,000 on

technical research to advance air transportation. In an industry where profits are small and capital investment is high, United was fortunate enough to use that money spent for research even during the previous years of depression would sooner or later reap large dividends in human volume—and it has. Its more intensive, economic work shown directly on the balance sheet, but even more than this, each development has brought the airline closer and closer to its goal of safe, efficient, rapid operation.

"The history of United Airlines operations program in its role of safety, which governs the movement of every

airplane on the earth system is all here. This role of three sets forth in order of respective importance, the factors of safety, passenger comfort, and schedule performance, as those which control the dispatch and flight of planes. In every phase of United's operations, safety is always the primary consideration."

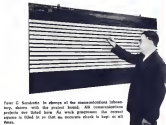
From the rules and regulations first United has set down, comes the statement giving the clearest reason for the research department, which works with the rule of three foremost in its mind. One need spend only a short time talking with the men in charge to be convinced that this is true:

Research Organization

All of the research activities come under the protection of the vice-president in charge of operations, J. A. Hendley. Communications is headed by J. E. Cunningham, with Pete Scazzetta in charge of the laboratory and the development of new radio equipment. Engineering research issues under Ray D. Kelly, who has with him four project engineers, each in charge of a separate department. Carl A. L. Tarkenton, M.D., formerly of the Army Airborne Medical School at Randolph Field, Tex., takes care of the medical department as well as of details connected with flight medical research.

Each of the various departments has its own facilities. However, there is also apparatus which is available to all departments. Foremost in the flight research plane, the only one of its kind in the world. Then there is a converted Boeing 247-D transport, less prone to be an available asset to the program of United's aviation research program.

Then there is the altitude chamber which enables the simulation of actual conditions and altitudes varying from sea level to 51,000 ft. The chamber is



Pete Scazzetta in charge of the communications laboratory, shown with the altitude board. All communications problems are solved here. As work progresses the research plane is fitted in so that no research should be kept in all times.

used in a variety of projects including radio apparatus testing to enable proper operation, suggest tests in connection with the provision of oxygen for passengers during high altitude flight, as structure testing for variations due to varied conditions, besides many other types of apparatus and problems which will present themselves when action starts regular high altitude operations.

In a cold chamber, engineers are able to simulate conditions of temperature and humidity ranging from -80 deg. F and zero percent relative humidity to +125 deg. F and 50 percent relative humidity. Much of the equipment tested in the high altitude chamber must also be put through its paces in this chamber as that there can be no doubt as to its efficient operation.

The vibration table is another piece of equipment, specially designed by the United's engineers, to test radio and

other equipment which is susceptible to various forms of vibration. Finally comes the drag table which gives equipment the real test by a sudden drop of 18 in. on a hard metal surface. United Airlines is the only airline in the world to possess these various forms of special research testing apparatus and when some point of apparatus has successfully made the passage there is not much doubt that it will operate under practically any condition.

Communications Laboratory

Pete Scazzetta, head of the communications laboratory, has a staff of nine engineers, two mechanics and two draftsmen. The lab was originally formed in 1929 and, stationed at Oakland, Calif., consisted of a group of three men headed by Thorpe Blomstedt. In 1939 it was moved to the La Salle-McCord Building in Chicago and from there it

(Turn to page 10)



J. A. Hendley, vice president in charge of operations. Right the vibration machine in which communications devices and flight equipment are tested to learn susceptibility in flight. Control table is in background.



Ray D. Kelly, in charge of communications research. Under his supervision, United has made numerous contributions to radio research, and operations.



A portion of the research laboratory. In the background are benches where apparatus of various sorts is built. Through the doors on both sides are test equipment, including vibration table, test altitude testing cold chamber, drag test machine, the wind test the same equipment.



Ray D. Kelly is in charge of communications research. He and his group experiment with in build passenger comfort and improved design of air seats.



Mainliner Maintenance

United Air Lines takes great pride in its mechanics. There's ample reason!

"**A**IRLINE maintenance has come a long way since the old days," said one of United's officials recently. "At Maywood Field just outside of Chicago, where we used to overhaul the old planes, we had only one spare engine, and we didn't know how to compress or overhaul it. Compressors were portable fans and when a pilot complained that his compass was not right we installed the spare and put him on the shelf. When the next pilot complained, he got the spare, and so on. Today we not only know how to compress and assembly operate but we have test equipment for it. When equipment goes back into an airplane after an overhaul, we know it is going to work properly. There's no guessing today. Now we're sure."

Air travel has become so seriously accident-prone these days that passengers seldom catch the real spirit of the maintenance mechanics. Airplanes

are safe, engines are dependable, the passenger gets where he wants to go—New York to the West Coast overnight if he wishes—and high speed and safety are taken for granted. The part that maintenance plays in today's superlative airline performance is seldom mentioned in the air traveler's consciousness.

Maintenance technicians along United's coast-to-coast lines are among the most skilled men in America. Six men standing at this purely glibly-defined task even his airplanes are more carefully than these airplane and engine specialists do their particular part of an airplane when a ship comes rolling into their hangars. Perfectness in job performance means nothing to them. They look for trouble, and they find potential trouble long before it becomes actual.

Smoking is forbidden, so let's watch the mechanics and inspectors at the Mainliner fix one Chryseum where United's

overhaul shop is located. The mechanics are inspected daily by skilled mechanics along the run, but at 600 hours they are routed to the shops for what United calls a plane overhaul. They could use such longer, but this is a conservative time limit. It is conservative in the same way that you might double to change the oil in your car at 400 or 500 miles instead of the 1,000 miles recommended by the manufacturer.

So after 600 hours of flying time, one Douglas is routed in Chryseum. It is maneuvered into the hangar and dozens come to rest at a spot where overhead work stands may be lowered along each side of the pilot's cockpit. Two portable stands, mounted on roller-skid wheels are locked in position below each of the great twin-row Wasp engines. A portable test bench for checking the hydraulic system is also next to each position.

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After 600 hours of flying time, United's Mainliner is routed in Chryseum for a plane overhaul at which time the engine has changed in about 100 hours.

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By G. S. Gray
Special Cable to Aviation

THE August 16 bombing of London is like Mark Twain's account on the report of his own death—greatly exaggerated. At this time the only bombing is a southeast suburb, an officially reported, and Croydon Aerodrome which anyone ought to have been rebuilt or abandoned ten years ago, and buildings to east of London far outside London area.

Naturally casualty will not allow details of bombing at Croydon, but one may say that German attack of perhaps a dozen dive bombers with strafing fighters came through high cloud without warning directly from the direction of approach of Dutch, Belgian, and German warships before war French used to come up from south.

First notice of their presence is those in offices and workshops, war housing of London. Number of killed and

sounded seriously wounded but we not have been large pelting by results at other aerodromes. Equally we cannot specify damage done either in RAF equipment or to work in progress but Croydon is not a first class aerodrome and there are no workshops of leading aircraft constructors within many miles from it.

Attack seems to have been realization for our need in Leffemport near Paris aerodrome now used as German base. My hope for raids on south England probably to gravity and increase our British feeling amongst French and as persuaded coverage for Croydon.

There was no interference with the German bombers when coming in to bomb but Spitfires and Hurricanes were already among them before they were out of sight on the way back and some of them got hit.

Naturally there are many machine works near London including aircraft works well known to Americans and Germans and the London telephone di-

rectory but none as first class important as London area. Besides London is of less importance from industrial view than usual collection area of manufacturing cities.

Even as seat of government London is not essential. King Albert ruled his South Sussex England from Winchester and kept out the Dues. Most government departments have dispersed their home operating machinery in different parts of the country. Heads of departments and immediate staffs in London itself are well protected in solid buildings of great situations situated in steel steel and concrete.

Some critics argue that destruction of some government departments would materially slow down progress toward victory. I could make give individual examples.

All big aircraft and motor plants all parts of country have dispersal plants in other parts. If any one factory is destroyed production will still go on and no factory has yet been damaged enough to stop its production. New factories in the parts and complete products are appearing every week and output of previously effective types has kept up almost under bombardment. Best estimates are that we stand at German target.

No new German airplanes showing up yet but pressure their designers not stop. We have seen types now in production far enough ahead of existing types to take care of anything they may produce.

Spitfires and Hurricanes beat Messerschmitts and Heinkel fighters on maneuverability and gunpower, though



Pilot and copilot of a German bomber. Before the control column.

not so far better as offensive defense Heinkel, Dornier and Junkers bombers may mean for our fighters.

Superiority of our pilots and gunners shows advantage of having shortening and fighter loaded over droning and propelling. Atmosphere of fighter attacks while squadrons going into action just that at Bagley Club waiting team onto the field.

Landing at fighter station recently well-known after called some came back growing to tell commanding officer that a captured pilot reported in a deal from his parachute found himself with five Messerschmitts on top of him. He dived for air and pulled up while following German dived right at Spitfires aimed to know whether far to claim victory as no that was first. This proved a more urgent problem than number of enemies shot down,

which was taken in matter of course.

Figures for the past two days show what is coming to Germans who arrive in mass. Sporadic raids of small numbers more difficult to catch before they could hit but of London raiders will probably touch them they are too easily.

Bagley calculations show that if Germans war alone were left unopposed they would take about five years to reduce London to rubble. Even though we might not even London reach they will not be left unopposed.

Remember that Hitler has to guard two thousand miles of coast from tip of Morocco to bottom of France. Of this our ancestors from Soundness initially landed a thousand miles a thousand years ago. Watch on start doing it again. And Hitler cannot tell where our war has come to stop before starting for Berlin.

BOMBING OF LONDON

British Press photo



A typical British anti-aircraft searchlight vehicle, the searchlight of London. There can be some 100 of the units that observe the planes and control the guns. They aim to the one with the microphone that controls the fire.

IN AMERICA

HOW CIVILIAN SCHOOLS TRAIN MILITARY MECHANICS

The private aviation schools in this country are doing a superb job in preparing mechanics for the Air Corps. This is an account of the air defense program at one school.

By C. C. Mesleley, President Curtiss-Wright Technical Institute



BECAUSE we have been training boys here to make a living the Curtiss-Wright Technical Institute has become, in a period of ten years, the largest school of its kind in America. Other fine private aviation schools have also prospered and grown, despite the fact that we have a \$4,000,000 public school machine in this country. While the public schools have remained loyal to the traditions of the past, the qualified aviation technical schools have kept step with the world's most vital industry.

That is why the U. S. Army turned to the leading private aviation schools of the country when an emergency arose which required the immediate training of thousands of competent aircraft mechanics. Our military was trained that the appreciation of technical

(Turn to page 138)



Discussions of the subject match those of some complete mechanics. Many varieties of planes, engines, and accessories are used about for the 1,000 students.

Others receive hands-on experience working on a plane through the operation of a bank of twelve engines and controls. Complete as this procedure is demonstrated with the equipment, including instruments, adjustment, running in, servicing and inspection.

Left: Some of the school's special equipment is mounted in a rig which duplicates the work and service conditions of a plane. This rig allows the operator of the engine to maintain without benefit of the actual plane.

IN GERMANY

NAZI YOUTH ARE TRAINED FOR AVIATION

Training is the primary plank in the Nazi aviation platform. Boys begin with small model planes and proceed step by step until they are flying in Germany's combat airplanes. Here are a few lessons in their education.



Here, first machine gun instruction is in progress, with machine guns mounted in a cockpit. Boys begin with small model planes and proceed step by step until they are flying in Germany's combat airplanes. Here are a few lessons in their education.



(All photographs from the U.S.A.)

Research Girds For War



SCIENTIFIC research in Aeronautics has suddenly changed its complexion. A new and emphasized necessity is facing the research worker in universities, in industry, and in government. A wholly new point of view is being forced upon him.

By choice and by instinct, America's industries have always been geared to a peace-time economy. By far the greatest part of our research effort has been directed toward producing cheaper and better goods that make for higher standards of living. We have been spending millions annually to improve our foods, our housing, our cars, and our airplanes. Comfort, utility, and economy have been the objectives. No one can doubt the phenomenal constructive nature of our industrial research.

But elsewhere this has not been so. Although the handicrafting has been so much for many years, we are just beginning to comprehend something of the tremendous scope and efficiency of the German industries that are now leading her war machines. Her industrial organization has been superb. The success of her armed forces has come about largely because the processes were carefully planned, well stocked, smooth running plants for the production of essential war equipment.

It is obvious, however, that so much industrial accomplishment even springs forth from out of nothing. It is only the result of organization to the task designs. No nation in Germany in the last few years could fail to be impressed by the breadth of planning, coupled with careful attention to the smallest detail, that characterized German in-



De Havilland model featured in the prototype research model.

dustry. When Die Tag came—everything was ready and in its place—even in the last days of peace. But organizations alone couldn't do it all. Beyond it was an accumulation of many years of patient work in research laboratories and careful experimentation with small-scale production. Simply by watching the magnitude and direction of scientific and industrial research in Germany for the past decade should have yielded clear signals as to what Hitler had in mind. It is astounding that so many signs should have been overlooked or underestimated.

Germany has always been noted for outstanding research achievement in many fields. Their chemists, their metallurgists, their aerodynamicists, have always been at the front rank. Their schools and universities have been centers of research for years. Even during the blackest days of the middle nineteenth century, the flow of research was never allowed to go out. When the present leaders of the Nazi party came into power they recognized the part that research would play in their effort to reunite Germany into a world power, and very actively they encour-

Talk of airplanes by the thousands has emphasized production problems, but research must go hand-in-hand to preserve the superior quality of our flying equipment. Here are the broad outlines of our plans to enable research to meet wartime requirements.

By S. Paul Johnston, Coordinator of Research, National Advisory Committee for Aeronautics

tried their earliest efforts on forcing the pace of research so that when the time came for their great military machine to begin to move, it could do so under a full head of steam.

No great military movement in history was so widely advertised as that in advance to war. Hitler's drive across Europe. No country ever went to such pains to show the world what she had in mind then did Germany during the past four or five years. And no people have been so blind to the significance of events that transpired under their very noses as have been the democracies of Europe and America.

Far from concluding what they were doing, the Germans in the past few years have openly boasted of their attainments and have been busy and willing to show the world what was going on. Hundreds of visitors to German industry in recent years have been shown the great producing plants turning out airplanes, guns, and tanks, the great system of roads and railroads crisscrossing Germany from north to south and east to west, not to mention airports and landing fields on a scale far beyond the possible needs of her commercial air services.

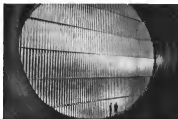
Such things are largely the fruits of research. Looking back, it becomes increasingly plain that all German research of the past decade was aimed toward one objective—the creation of an efficient, advanced military machine. When the democracies failed to recognize in watching Germany's progress over the past decade in the fact that there is no essential difference between peace-time and war-time economies at the industrial level. The transition from peace to war does not involve any tremendous changes in the internal program. The difference is

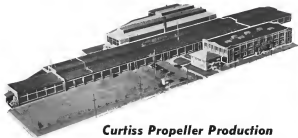
(This is page 102)



Part of the aircraft plant at Landing Field, Virginia. Some like buildings at the left house the instruments tested. Beyond the center the 1935 prototype aircraft, one of the earliest planes of equipment in the background, ships and engine laboratories.

To help wind around corners at 300 miles per hour, the function of this huge wind tunnel in the 1935 prototype plane.





Curtiss Propeller Production

The Curtiss Propeller plant is one of the key units of the defense program. This is a story of the excellent job they are doing, after expanding more than twenty times their size in two years.



Fig. 1. Rough Turn Department showing stress lines and prove holes.



Fig. 2. Roughwood Dept. 9000 grinding blade stock from 18" diam.



Fig. 3. Tuckwell drill shop showing 40-hole stock and hole open.



Fig. 4. Rough Turn Department showing stress lines and prove holes.



Fig. 5. Rough Turn Dept. testing Aluminum Alloy blade stock.



Fig. 6. Rough Turn Dept. grinding Aluminum Alloy blades.



Fig. 7. Clamping table at 42" station with perforator.

A LITTLE over ten years ago there resulted from a few acres of Curtiss-Wright property what turned out to be the first plant of an electrically controlled propeller. The development work began to turn and the propellers began to fly. Step by step, work progressed and designs were perfected which ultimately led to the present Curtiss-Wright Aluminum Alloy propeller and with it the Curtiss Propeller Division, being established in a separate area (including unit of the Curtiss-Wright Corporation).

Five years of ten years ago—now two or three years ago—thought for comparatively modest beginning at the Curtiss Propeller Division would mold itself into such a vital part of the general defense program. Willing to do more than its share, the company has undergone a tremendous expansion program which started with 17,000 sq ft at the Curtiss Aeroplane Division at Buffalo and has grown in two years to the present 135,000 sq ft at Clinton, N. J. plus 43,000 sq ft at Pittsburgh, Pa.

An additional plant now under construction will provide a total of a half-million square feet when completed near Caldwell, N. J. in early October of this year. The present 7000 employees now use a total of 225,000 sq ft. About 1,200 of these are engaged in actual manufacturing processes while the other 600 are divided up among the engineering, sales and office staffs. The new plant will make room for 1,800 new employees.

A description of the operation of the plant would not be complete without selling some of the preliminary work that is done before the propeller is actually scheduled for production. Orders coming into the plant from the customers are received by the Sales Department. Prior to the receipt of the order for one engine-propeller combination, all of the necessary performance data is obtained. This is then turned over to the manufacturing department and the technical section in order that the propeller design giving optimum performance can be selected (or that a new blade can be designed). Details of construction are combined with the manufacturing department in order that the most efficient operation can be obtained and the most desirable control arrangement be determined.

When this work has been completed, the information is turned over to the Sales Department to do the necessary engineering and make the quotation to the customer. If accepted, the order is received and the sale order is issued by the Sales Department. Copies of this go to engineering, manufacturing, construction and the accounting departments. At this point the manufacturing department checks further into the matter with the shipping manufacturer in order to make that the installation is correct.

When all of the performance data has been turned over to the Engineering Department and checked, a release giving structural details of the propeller is given out by them. These release sheets (Fig. 2) are made up according to the detailed performance and the assembly numbers of the various parts of the propeller. Of course if the man-

ufacturing is a new one and not according to any standard installation previously designed, it may be necessary for the Engineering Department to design new detailed parts to meet the special requirements.

Releases are issued to the Manufacturing Department, through the medium of the planning and scheduling departments. This is the heart of the production system which sends out work orders to the various sections of the production line telling them what to build and when. Along with the production schedule, the Planning and Scheduling departments also directs the purchasing department in the new material required to complete production of the new order. Purchasing is sure that the necessary purchase orders with copies going to the accounting, inspection and receiving departments. Once all of this paperwork has been completed the shop is ready to start work on all of the material that will eventually comprise the propeller.

To facilitate the production, the plant has been divided into six departments, these being: (1) engineering, (2) manufacturing, (3) inspection, (4) receiving, (5) sales and service, and (6) warehouse.

Engineering Department

The Engineering Department is in turn broken down into three sub-departments. The first of these is the Research Department whose function it is to carry through an advanced stage of design of new ideas, both as regard to propellers and controls. It is from this group that the planning of ad-



Fig. 5. Bond fiber aluminum alloy blades after polishing.

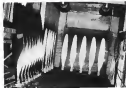


Fig. 6. Blades in point spring berth before assembly.



Fig. 10. First halves of propeller prior to shipment.



Fig. 11. First check of hollow steel bonded propeller.

various propeller designs is carried out. They are the eyes of the Engineering Department which look into the future and see when and how propellers can be improved to make their efficiency increasingly better.

The experimental design and test section takes the developments from the research section and has the responsibility of developing these into a practical manufacturing unit. The experimental part of this department requires the research projects on the basis of coordinating with the production section to run any production problems, while at the same time making certain that it is able to run all necessary tests. The third group is the technical section whose job it is to guide the policy of blade design and selection from an aerodynamic viewpoint in order that the propellers will be available for new designs of engines and airplanes.

Manufacturing Department

The Manufacturing Department is divided into seven sub-departments, from here: (1) receiving, (2) planning and scheduling, (3) purchasing, (4) machine shops, (5) assembly, (6) shipping, (7) tool design and methods

The head of the production line is the receiving department where all of the material from the outside suppliers comes into the plant. Here it is inspected and divided into the various categories depending upon what type it is. If the material has been completely by a subcontractor, it goes directly through inspection to the Finished Stock department to be placed in stock. If for further manufacturing by the company, and the raw material has been passed by the receiving inspection department, it is introduced into rough storage.

Aluminum Alloy Blades

The largest blade blanks are represented out of the Rough Storage department (Fig. 1) against which even shop order may have been made for that design of blade. From here it comes down through the production line which occupies nearly one-half of the area looking (See Fig. 12). The first operation is to enter up the ends of the blade blanks, drilling a hole in the tip and the base of the blade and making certain that it is as nearly straight as possible. A Monarch lathe then turns down the end of the propeller

(Fig. 7), cutting the hub close to its actual size. From here it goes into a Rotator machine (blade guide machine made by the Engineering Research Corporation) which turns the blade to exactly its exact shape, starting with the 18-in. stubs out to the tip (Fig. 3). This operation forms the blade in within about 1/16th of its actual size. The next step out the rest of the propeller blade from the 18-in. stubs is toward the hub. This operation is done in a Sanderstead blade polishing machine (Fig. 6). In this machine a master blade rotates at the same speed as the production blade and the two synchronized together so that the blade being cut takes exactly the same size as the master blade.

To make certain that the blade has not warped during all of the machining operations, it is mounted on a checking table, (Fig. 4) the blade angle checked and the various sections checked. To remove tool marks the surface is filed down by hand (Fig. 8) so that it is uniform from hub to tip, the proper camber and alignment being secured by checking with templates, using the surface of the checking table as a reference plane. The prop mounted on the end through which the pitch is

changed, is held in the correct position by a set screw—the hub for which a drilled hole is made (Fig. 7). In this travels into the balling room to arrive the polishing operations that put on almost a mirror finish. This completes all of the manufacturing operations on the blade. Afterwards it is balanced on a balance stand, being checked against a master blade. Once balanced, the blade is then placed (Fig. 9), inspected, and sent to the Finished Stock Storage.

The Hub Department

The hub forming as it is received weighs approximately 400 lb. At the Curtis plant, 90 machining operations performed on this hub trim it down to a weight of approximately 30 lb, and this is an exact job.

When the forged hub blank has been repurified from the Rough Storage Department (Fig. 1) it is released on a large Miller (Bos. vertical) boring mill for the first machining operation. In this machine a hole is bored through the center of the hub, where the engine shaft goes. The blade barrel and outer surface of the hub is then roughed out. A machine that handles three hubs at one time is used for taking the final cut on the inside diameter of the blade barrel. After this is completed, the hub is operated on a Bell Planetary-type milling machine (Fig. 14) and the inside and outside of the blade barrel is turned down. The operation of taking a rough cut from both the inside and the outside diameter of the barrel at the same time, is a new method of using the Bell machine. In order to prevent distortion while the hub is going through production, it is necessary to remove the material in small cuts. A double head hydraulic machine is used for rough turning the corners of the hub between the barrels. This machine brings the shape of the hub down close to its actual size.

After all the rough cutting opera-

tions, the hub is sent to the last turning department where it is last-treated as being it up to the proper strength. It is after this operation that all of the finished machining is done. This step along includes applying the hub which is done with a Laporte finish which is pulled through the hub by a hydraulic mechanism. Other interesting points of the finished machining are the grinding of the cone seats, the made diameter of the face of the blade barrel, and the face of the hub which is done in order that the necessary close tolerances can be held. For instance, a tolerance of plus or minus five tenths of one thousandth of an inch is allowed in the inside diameter of the hub barrel. After these finishing operations are completed, a Latent-Gilford finishing machine (with hydraulic feeding mechanism) are used for accurate drilling of the small holes in the hub

The drilling of these holes must be extremely accurate as it is dependent on when the hub is assembled with the rest of the propeller every part will fit perfectly. Following this, the hub is polished and sent to the inspection department and then then to the Finished Stock.

The hub department is located on the opposite side of the main aisle, which runs the complete length of the plant, from the blade department (see Fig. 12). The head of the hub department is approximately opposite the rough stock department and from there the production line proceeds down to the point where the hub is finished and is turned directly over to the central inspection department.

This production line is well laid out so that a smooth flow of material from start to finish is able to be maintained

(Continued on p. 45, early 1948)

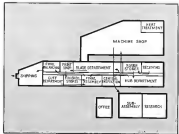


Fig. 12. The flow of production through the plant begins at the right end and travels through inspection to shipping, which is located at the left end (see Figure 13).



Fig. 13. Propeller shipping beam in view of laboratory.



Fig. 14. Bell Planetary machining steel hub barrel.

Warplane Factories in Germany . . . Part 1

By Paul H. Wilkinson
Consultant, Diesel Aviation

Factories assembling the 124 observation planes under construction. At the far end of the line the BfW, 112 models are being mounted in the airplanes' pods.

THE warplane industry in Germany has attained such enormous proportions that it is difficult to visualize it in the United States. Where we think in hundreds, the Germans think in thousands of warplanes and a yearly production of 12,000 warplanes is now chiefly pay for them. From what the writer saw when he visited these factories last year Germany has a capacity of 30,000 warplanes a year right now without expanding existing facilities. These factories are not working at maximum capacity but only produce airplanes and reserve planes and engines for the war air fleets. Should the need arise, the tremendous production facilities of these factories can be thrown into high gear immediately with adequate supplies of material and trained personnel at their command.

Warplane production facilities in Germany differ widely from those to which we are accustomed in the United States. Here we have sprawling capital automobile factories with practically all of the departments under one roof. As a result, our warplane factories are almost nothing but shops which could be completely destroyed from the air. Nonetheless to say, we have not provided air raid shelters for our employees or proper underground protection for our factories despite the obvious emergency which we are still in.

In Germany, each warplane production factory is a self-contained unit comprising machine buildings spread over a large area, often camouflaged with trees. Workshops are kept in country fields whenever possible to avoid enemy shadows and specially constructed anti-aircraft gun platforms and guns are provided on the roof. Subterranean air-raid shelters with ade-



Continued

quate ventilation and provisions systems are located near the buildings to accommodate all the employees deep in the bowels of the earth.

When one visits a production unit in a warplane factory in Germany, one is usually taken to the main factory where only development work and small series production is carried on. Small series production means here a few hundred in a demand or more warplanes a year and is considered negligible. Real mass production of warplanes by the thousands and tens of thousands takes place in special production factories in

different parts of the country so arranged that damage to one or more of them will not appreciably affect the output.

With the exception of Junkers, none of the German warplane factories build their own engines. Engine production has been standardized and only the very minimum of types and models are turned out. The entire German Air Force is built around three standard engines—the 1,200 hp Junkers Jumo 211, the 1,200 hp Mercedes-Benz D12 601 and the 1,800 hp BfW 132. In addition, thousands of Junkers Jumo

Division of Diesel assembly line in a Messer schmidt factory showing the 112 observation planes under construction. The customer engine models are in the line of the airplanes' bodies.

Factories use and engine stations of a Daimler-Benz 112 high-speed engine powered with Mercedes-Benz D12 601 liquid-cooled engine. The assembly of the fuel injection system is noteworthy (center right).

Both men and women are employed in all warplane factories in Germany. Here a mixed team is getting the building together to a Mercedes-Benz D12 601 engine installation in a Messerschmidt BfW 112 fighter-bomber. Photo shows the engine working room.

2000s of from 700 to 1,200 hp have been produced for a special long-range loading unit. Aircraft engines in Germany are built along mass production lines similar to those used for automobiles and the engine factories can supply the needs for 50,000 warplanes a year.

Hinkel He 111 twin-engine bombers are one of the best known German warplanes and many thousands of them are in construction. These planes are built by flow-line production methods at Daimler-Benz and elsewhere on a big scale. The latest Hinkel bombers have a speed in excess of 380 m.p.h. with full load and should not be confused with the older models used during the earlier stages of the European war. In addition, in these warplanes considerable quantities of the He 112 single-engine fighters having a speed of approximately 375 m.p.h. are beginning to make their appearance armed with two short guns and a number of machine guns.

Recently rivalry has existed between the designers of fighting planes in Germany and the firm of Hinkel and Messerschmidt have each in turn held the world's speed record. In March, 1939, a Hinkel He 112 U fighter was flown at a speed of 463.9 m.p.h. only

(Turn to page 107)



The Pitcairn WHIRL WING

The new "jump" autogyro designed by Pitcairn has been a big step in rotary wing aircraft and its roadability feature should be of great interest to the commercial operator.

By Agnew E. Larsen, Chief Engineer and General Manager,
The Pitcairn Autogyro Corp.



The Whirl Wing is capable of a vertical ascent from the ground in less than 15 to 20 ft., depending on conditions of the wind, from which point it "takes off" as shown by the path of the dotted line.

A. E. Larsen, chief engineer, left, and Harold F. Pitcairn, president, of the Pitcairn Autogyro Corp., look over the hub of the new ship.

THE steadily-advanced Pitcairn Whirl Wing Autogyro is an outstanding development in the field of aviation. It is a completely new ship in every sense of the word, and its unique performance affords unlimited possibilities in the fields of civil, commercial and military aviation.

The engineering and experimental work that preceded the actual design and construction of this ship, rather than through seven years. Studies were made in this country, and by the Pitcairn Autogyro Co. in England, of all available practical as well as unperfected data. The aim was set at developing an autogyro which had the safe flying and slow landing characteristics which have been under development since 1921.

In the preliminary studies for the design of the Whirl Wing, full consideration was given to those features

which should be included. The advantages and characteristics of placing of the motor in the nose of the ship or in the center of the ship were carefully weighed. The latter position strongly favored the out-of-the-center position.

The advantages gained by enclosing the motor within the fuselage, back of the pilot's seat, are numerous. First, the substantial increase in the range of vision for both pilot and passenger were of major importance. Second, the fact the power to drive the rotor-starting shaft could be taken from the propeller shaft (the front) of the engine, permitted the utilization of the available horsepower for turning the rotor shaft. Third, the second-shaft ending of the engine could be controlled under all conditions. This 1000 pilot has several other interesting aspects worthy of mention. Because the autogyro can slow down to a stop at low speeds, the motor on previous ships, whose landing depended on the air speed, were overruled. In the Whirl Wing, the use of a direct shaft from motor



In the rotor system, the air, which passes through a hydraulic line, is forced by means of centrally disposed balls placed "A" around each cylinder head and back.

to turn motor required the installation of a fly wheel to remove any tendency towards forward rotation in the shaft. The fly wheel was designed with an internal damper for action in permission for forcing the air through the cooling system. It also incorporates a ring gear which makes possible the use of a standard automotive-type electric starter.

In this new cooling system, air is drawn in through a grill located in a high-pressure area on the nose of the ship. The air is forced through a duct which passes under the floor and exits to the fan housing. There is a small radiator in the duct which cools the oil for the transmission unit in the nose of the ship. After passing through the hydraulic line, the air is cooled, by means of centrally disposed balls placed around each cylinder head and back. A second set of cooling radiators is located

in the cold air stream for cooling the engine oil. After the air has passed the engine it goes into the rear of the fuselage, and exits that were carefully located so as to be in points of negative pressure, provide means of exhausting the heated air from the ship with a minimum air power consumption.

On the many operating features of the new Pitcairn Whirl Wing, the most important is the method of take-off. The preliminary ground run has been completely eliminated. From a locked-wheel position it actually jumps vertically



The rotor blade is attached to the hub through two blades "B". The hydraulic line "A" forces oil from the cylinder "C" around the rotor which is connected to an arm on the blade. This controls the pitch of the blade. "D" is a blade which the blades in turn, up and down in the vertical plane. "E" is the arm connecting the blade and hub.

into the air and soars smoothly into forward flight. The height of this vertical take-off varies from 15 ft. to

still less to about 25 ft. under moderate wind conditions. This ability to ascend without any ground run advantages not only enables this ship to clear bridges, fences, and similar obstacles, but also permits it to take off from rough or broken-surfaced terrain.

Before considering any of the other advantages and improvements incorporated in this new ship, a brief explanation of the principles on which this jump take-off operation may well be given. These principles are relatively simple. The rotor, which furnishes all the lifting forces in the autogyro type of aircraft, has three blades that are threaded into the rotor-hub with high-pitch threads. A short lever arm is attached to each rotor-hub just outside of the threaded connection and small hydraulic cylinders are located at the points they contact bear against the small lever arms on the hub. When hydraulic pressure is applied to these three cylinders, the pistons are forced out against the lever arms which turn the threaded blade connections into the air hub. Since the pistons are locked, with the pressure applied, the forward or backward connections hold all rotor



One of the reliability features requires a secondary locking system. This is accomplished through a system of threads and ball-nuts. Thread "A" is connected to the rotor hub and ball-nut "B" is the ball-nut which fits into the hub.

The compact width of the autogyro is shown in its unique landing gear and tail arrangement. With the engine in the nose, behind the rotor, excellent visibility is obtained from the cockpit. Air space is better protected.



blades at the flat air take-off position. While the blades are in this position, the rotor arm, by means of the rotor drive mechanism, is accelerated to 300 r.p.m. while the ship is standing on the ground. Releasing the pressure in these cylinders permits the blades immediately to "uncover" the few degrees necessary for the blades to obtain normal flight pitch. Since normal flight rotation of the rotor is only 180 r.p.m.,

(Turn to page 28)

Heat treated to above 400 BRINELL...
yet **READILY MACHINABLE**

NICKEL ALLOY STEELS

For parts which must have high hardness to perform satisfactorily in service, heat treatment before machining offers distinct advantages. Workpiece and distortion resulting from heat treatment after machining cause to be an important factor. Straightening or other finishing operations to correct for such distortion are eliminated.

Especially interesting are present shop practices of airplane part and other mass production plants where machining heat treated Nickel alloy steel's ranging in hardness up to 400 Brinell. (above) stressed Hydraulic Propeller spacers of SAE 4340 heat treated to approximately 425 Brinell are machined with ease on a Ballard Mach-A-Matic in the regular production line at the East Hartford, Conn. plant of Hamilton Standard Propellers, Division of United Aircraft Corp.

In a recent demonstration on a standard Warner & Swasey turret lathe conventional high speed steel readily turned, standard and drilled a 2" bar of Nickel alloy steel to dimensions used at a business of 400 Brinell. The turning cut was fed at .012" at a speed of 47' a minute. The close behind chip showed no tendency to weld, break or harden. The smooth surface produced indicates that machining Nickel alloy steel at high hardness is not unusually difficult.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET
NEW YORK, N. Y.

AVIATION/September 1946

Grumman "Widgeon"



TO CARRY a pilot and three passengers plus baggage two-step from New York to Chicago at 150 m.p.h., is a pretty good job for any private owner plane. But when such performance can be obtained from a small amphibian, it's really worth sitting up and looking at. This month out of the doors of the Grumman Aircraft factory will roll just such a ship.

The new "Widgeon" is a four-place amphibian that has been built specifically for the private owner market. With this in view, the operations of the plane have been greatly simplified and it almost freed of gadgetry that must be maintained. The amphibian is a two-engine ship powered with new Bengay motors of 500 hp each. With a cruising speed of 150 m.p.h. and 180 gal. fuel capacity, fully loaded, the cruising range is 750 miles. From all reports, the single engine performance has

shown up very well, and the ship can be flown "brake off", with either engine inoperative.

The construction is of typical Grumman design and does not look a great deal unlike the familiar Grumman "G-21A". The wing consists of a single large box spar with two integral fuel tanks of 30 gal. capacity, each located in the outer section, directly behind each power unit. The outer wing panels join the center section just outboard of the engine nacelles, and all of the spars are fabric covered to facilitate inspection. For the most part, all control surfaces are fabric covered. The tail is divided into three watertight compartments comprising the low displacement with a hatch to and in mooring and docking, the engine cabin which is fitted with large Plexiglas windshields and windows, and the tail cone which is stowable from the outside as

well as the inside. The passenger cabin is fitted with four doors for the pilot and three passengers, and in addition there is an auxiliary door for a fourth passenger for emergency and other short land flights.

The designers of the amphibian were careful to obtain the utmost simplicity of flight control. To obtain this a wing loading of 12 1/2 lb. per sq. ft. was used which imparts landing characteristics on both land and water. The jaro tracking ridge flap also enhances the landing characteristics. The low bow was designed to prevent coming over the head and gives some of the characteristics of a tractor landing gear, while the wide spread of the wheels under ground landing and reduces much stress. On the water the ship is reported to be fast initially and can be turned so sharply that the inside wing tip moves backward.



New All-Metal Light Plane

WITH a top speed of approximately 130 m.p.h. from a Leaning 75 hp motor, a new all-metal ship, manufactured by the Kestrel Aircraft Corp., has entered the light plane field. The new plane has recently completed its first flight test which has shown some very interesting results. A line of the performance figures obtained from these tests were a landing speed of from 40 to 42 m.p.h., without flap, and a climb

of 1,000 ft. per min. for 1,000 ft. with the pilot the only occupant of the ship.

The test flights were made with a plane having a fixed landing gear and without flaps. Experiments are being carried out on the use of flap which is expected to greatly reduce the landing speed. Also a retractable landing gear is being checked and from the test data so far available the top speed of the plane is expected to be about 150

m.p.h. and the landing speed to be about 40 m.p.h.

Details of the new plane are far and without. The fuselage is of stressed skin construction with a large wind-shield giving excellent visibility. The wings are of a swept design being fully-covered. A constant propeller is used and the hydraulic landing gear is constructed by Shon Devcon. Production plans are under way.

The Junkers JUMO

211

By Paul N. Wilkinson
Consultant, Naval Aviation

Here is a description of the twelve-hundred horsepower Junkers Jumo 211 aircraft engine now being used in the Stuka divebombers by the German Air force.

THE extreme one which is being made of thousands of Stuka (Junkers Ju 87) dive bombers by the German Air Force in the European war focuses attention on the power plants with which these warplanes are equipped. That they are all equipped with the same type of engine goes without saying; emphasis as standardization is one of the essentials of military equipment in Germany. Junkers Jumo 211 engines are also used in high-speed fighters Ju 88 bombers and they have been installed in Italian bombers and fighters to an appreciable extent. Primarily, one associates the Jumo 211 with the Stuka and it must be admitted that the engine is a very obvious contribution.

The basic requirements installed upon when the Jumo 211 was designed were high power output at ground level and altitude, low weight, compactness, economical fuel consumption and maximum reliability. The all of these requirements have been combined in one engine is quite an achievement and is due to the wide experience which Junkers have had with water-cooled power plants. High power output is obtained by means of a five-valve, supercharged, low weight is made possible by refinement of design, compactness is obtained by locating the engine with its cylinders in an inverted row, economical fuel consumption is obtained by means of direct fuel injection, and reliability is ensured by overhauling the most rigid inspection control during the process of construction.

When the Jumo 211 was first produced in quantity in 1936, it was rated at 1,033 hp at 1,500 ft. and 972 hp at 14,500 ft. with 1,500 hp available on take-off. Since that time its performance has been considerably improved so

that now it has a rating of 1,200 hp at 5,500 ft. and 1,003 hp at 15,400 ft. and develops 1,200 hp for take-off. The weight of the engine is 1,200 lb. and its specific weight is 3.07 lb. per hp. These power outputs are obtained with 80 octane gasoline.

Apart from its inverted cylinder construction, the Jumo 211 follows conventional practice. The combustion and cylinder block is a one-piece casting of aluminum alloy with the blocks set at an angle of 10 degrees. The crankshaft is of overhead construction with connecting rods and is supported in seven main bearings. On the front end of the crankshaft there is a splined gear wheel which drives a gear pump wheel on the propeller shaft and provides a reduction ratio of 1.35 to 1.

At the rear end of the crankshaft there is a sub-shaft from which are taken for the supercharger and the electric generator mounted on top of the crankcase. A gear gear wheel is also provided at the rear of the crankshaft from which a gear train comes down to the two camshafts, the oil pump, the scavenging water pump and various small accessories.

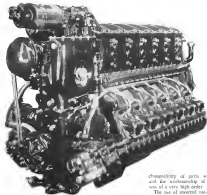
The valve mechanism is operated by means of an overhead camshaft along each cylinder head and two inlet valves and one exhaust valve are provided for each cylinder. The pistons are fitted with three pressure rings above the piston pin and one oil scraper ring below it. The connecting rods are machined from 15-ton steel forgings and have tapered bearings of unusually large area. The propeller shaft is hollow so that a steel gas can be fed through it and it is made with a large flange with a screw neck and holes for eight bolts for attaching the propeller in accord-

ance with German standards. The propeller reduction gear has an efficiency of from 98 to 99 percent.

Instead of the drive-shaft reduction usually found on high-performance aircraft engines, the Jumo 211 is equipped with a continuous high-pressure injection pump which injects the gasoline direct into each cylinder where it forms the correct mixture with the air forced into the cylinder by the supercharger during the suction stroke. Fuel injection is used on many of the military aircraft engines in Germany and has the advantage that there is no danger of engine stoppage after a power loss or during aerobically maneuvers. It also makes the engine less fuel-sensitive and permits a slightly lower grade of fuel to be used without impairing the performance of the engine.

The two-piece supercharger is mounted so that the axis of an impeller is at right angles to the crankshaft of the engine instead of parallel with it as is most common. The impeller is of the high-speed closed type and makes in the air through several vanes mounted in back and discharges it at high velocity through a nozzle around its periphery.

The altitude control is in the form of a valve or metal splines controlled by an aneroid pressure which transmits its position and adjustment to a small hydraulic servo-valve which opens and closes the throttle valve in the air intake of the supercharger. At high altitudes the engine operates due to the reduced atmospheric pressure and the means the servo-valve to increase the opening of the air throttle valve. The fuel consumption of the engine is approximately 0.45 lb. per hp. per hr. when it is cruising at an output of 800 hp.



simplicity of parts and excellent workmanship of the engine is of a very high order.

The use of inverted row-type engines such as the Junkers Jumo 211 and the Mercedes-Benz DB 601 for high-performance warplanes in Germany is in sharp contrast to the use of upright row-type engines such as those used in the United States and the Rolls-Royce (See page 122)

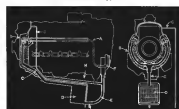
The lubrication system functions on the dry sump principle with two pressure feed and two scavenger pumps of the rotary gear type. The oil pressure ranges from 10 to 30 lb. per sq. in. Water is used as the cooling medium in contact with a scavenging pump with a circular header tank around the front part of the engine.

The use of water in a cooling medium of cylinder block which is used in most liquid cooled engines enables the Jumo 211 to be started quickly wherever it may be without requiring supplies of a special coolant. Drains are provided for an electric heater, an air compressor or vacuum pump, a shaft-driven and an electric tachometer and two machine gun gyroflexometers.

When the winter use of the Jumo 211 in mass production in the Junkers factories in Germany last year it was particularly noticeable that rigid inspection control was maintained during all stages of manufacturing. Even the crankcase castings were tested with Röntgen rays to ensure that the material was satisfactory and the wingmagnets of each casting were filed away for future reference. Most of the inspection work on small production parts was carried out in air-conditioned rooms with special electrical and optical apparatus

Complete accessories such as pumps and superchargers were tested and calibrated on special testing machines before assembly on the engine.

Diagram of circulation water cooling system of Junkers "Jumo" 211 power plant shown.



DEEP DRAWING OF METAL AIRCRAFT

PARTS with the

H-P-M FASTRAVERSE Triple-Action PRESS

H-P-M designed and built the first hydraulically triple-action metal working press. Today H-P-M Triple-Action Presses are widely used by the metal working industry.

One of the first aircraft manufacturers to foresee the many advantages of the H-P-M Fastaverse Triple-Action Metal Drawing Press was Douglas Aircraft Co. This company recently installed a 400 ton triple-action blankholder press for deep drawing fuselage heads and other similar aircraft parts.

Important exclusive features of H-P-M Triple-Action Fastaverse Presses are:

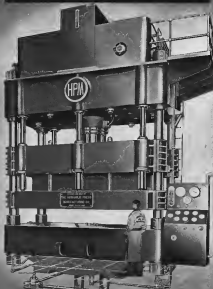
Automatic alignment of blankholder die may easily be corrected by blankholder down directly above.

Individual pressure adjustment of each blankholder for easy controlling the variation of blankholder pressure at the separate corners.

All three hydraulic columns function from only one H-P-M Hydro-Power Pilot-type relief pump directly connected by one flexible line to one electric motor.

H-P-M Guard Circuit operating system preventing overheat action with automatic shut-down press reversal.

The H-P-M Fastaverse Press is the only press designed to perform press deep metal



H-P-M

THE HYDRAULIC PRESS MFG. COMPANY, Mount Gilead, Ohio, U. S. A.

District Sales Offices: New York, Syracuse, Detroit and Chicago • Representatives: Boston, Worcester, Hartford, Providence, Pittsburgh, Akron, Cleveland, Cincinnati, Flint, Seattle, San Francisco, Los Angeles • Foreign Representatives: Canada and England



The Culver Cadet

THE Culver Cadet's range of 600 miles and guaranteed cruising speed of 120 mph is aided in opening up many new flying possibilities for the private pilot. Many comparatively new features for biplanes are incorporated in the design of this ship, one of the press men being the retractable landing gear which enables the plane to attain a speed of 140 mph. A dual wing is also incorporated which provides better lateral control at low speed and increases the ease of landing.

The Model L-CA is a two-place, low-wing monoplane powered by a Continental four-cylinder air-cooled motor rated at 75 hp. The fuselage is of semi-monocoque construction with a stressed skin covering of reinforced plastic-type material. The cockpit is enclosed by Pyralis and doors are provided on either side of the cabin. Doors

open forward and permit entrance or exit over the wing root. The seating arrangement is side-by-side and dual stick controls are provided.

The wing structure is of the monospar type, the main spar being of compressed plywood and veneer construction to take the entire bending moment and shear resulting from the air loads. The wing is joined to the fuselage fittings by means of a chrome malleable steel brace truss which is located between the main spar spar and the rear secondary spar. The truss is of the left cantilever type, with three low drag slots located near the wing tip. The leading edge of the wing, in front of the main spar, is of plywood construction, and the whole wing is skinned over. The ribs are of wood construction. The tail section is a cantilever type, offer-

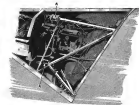
ing a continuous elevator provided with a trimming tab.

The retraction of the landing gear is accomplished by means of a mechanical operation through a wheel located in the cockpit between the two occupants. Two bars of steel wheel will extend or lower the gear. In its retracted position, each of the individual legs of the gear is fully isolated by a flaring.

(Continued on page 122)



The cabin of the Culver Cadet has ample room for both pilot and passenger. Instruments are placed so as to be easily read by the pilot. Entrance is through a door opening passage into the rear with stairs leading to Pyralis.



The engine mount supports the motor by vibration absorbers "X". The heavy tubes within the block extend back to fit into the fuselage while the side members support the wall of the propeller, giving easy access to the engine.



Presenting the New GRUMMAN "WIDGEON" Five Place Twin-Motored Personnel AMPHIBIAN

GILLIES AVIATION CORPORATION

Bethpage, Long Island

Aviation's Potential Profitless Prosperity

By Selig Aitschul

COME what may, it is well understood that the aircraft industry will not want for lack of business in the immediate future. Loss exists, however, in what profit margins, if any, may prevail in the industry. It is this unknown element that has caused investors to view aircraft securities with a critical eye in an attempt to appraise all possible factors.

The excess profits tax bill resulting from a compromise between the supporters of the Treasury and of the joint congressional committees, may at least clarify major uncertainties facing the aircraft industry.

Encouraging is the provision calling for the discontinuation of the Variable Transient Air profit maintenance on ships and aircraft contracts. This Air has long served to discriminate against shipyards and aircraft builders. The proposed excess profits tax would tend to equate treatment awarded all companies manufacturing for the national defense program.

An important forward step is the special amortization plan for defense plant expansion. It is proposed to allow those industries which have accumulated their plants and secured new equipment since July 30, (the date of the President's defense message), to amortize the cost of the expansion over a five-year period or even shorter period of time if the emergency ends within five years.

The excess profits tax provisions proper, both present and proposed, may be beneficial to corporate executives and accountants. Under the present, a company has the option of calculating its excess profits tax obligation either on the basis of its average earnings for the years 1935 to 1939 inclusive or on the basis of average return on invested capital in three years. Under both options the excess profits tax rate is the same.

The invested capital provision of the two selections of the last war caused litigation and involved questions which were not settled for years. Apparently this provision is again included in an attempt to mitigate, for those companies whose profits in recent years have been subnormal, the severity of a levy based solely upon average profits for the designated base years.

The excess profits tax bill as it now stands would severely affect the aircraft industry as its status under the proposed excess profits tax bill. This

TABLE 1
Improvement in Airline Operations
First Half of 1940 Compared to
Like 1939 Period

	Passenger Miles	Passenger Load Factor	Passenger Turnover	Passenger Cost	Passenger Revenue	Passenger Profit
Regione	41	17	10	20	20	20
Boeing	41	17	10	20	20	20
Boeing	41	17	10	20	20	20
Boeing	41	17	10	20	20	20
Boeing	41	17	10	20	20	20
Boeing	41	17	10	20	20	20
Boeing	41	17	10	20	20	20
Boeing	41	17	10	20	20	20
Boeing	41	17	10	20	20	20
Boeing	41	17	10	20	20	20

AVERAGES

	Passenger Miles	Passenger Load Factor	Passenger Turnover	Passenger Cost	Passenger Revenue	Passenger Profit
July 1939	41	17	10	20	20	20
July 1940	41	17	10	20	20	20
July 1939	41	17	10	20	20	20
July 1940	41	17	10	20	20	20
July 1939	41	17	10	20	20	20
July 1940	41	17	10	20	20	20
July 1939	41	17	10	20	20	20
July 1940	41	17	10	20	20	20
July 1939	41	17	10	20	20	20
July 1940	41	17	10	20	20	20

ing the base period designated with earnings attaining a sharp peak in 1939. Moreover, as yet the industry has been unable to have developed means to equal to the cost where it could obtain sufficient exemption to permit any important extension of earnings. Unofficial estimates have indicated that in the case of certain aircraft builders, profits before taxes would need to be approximately one-third higher than last year in order to finish with the same net profit.

Inasmuch as representative companies for 1940, are on their way to at least double last year's profits on a seasonal basis, the new excess profits tax bill does not appear too stringent. While the government would obtain a substantial share of the increase in corporate profits, the aircraft manufacturers would not be prevented from making money.

An aircraft manufacturer has never fully eliminated the high profit margins anticipated early this year; they are now less susceptible to any drastic market shrinkage. In fact, even after consideration of the drastic effect the new tax law may have on earnings, the earnings are such that leading aircraft contracts continue to sell at a low rate in volume in anticipated earnings after all tax deductions.

Less fortunate is the air transport industry as its status under the proposed excess profits tax bill. This

growing industry did not have its first profitable year until 1936. Using the 1936-1939 period as an average, it is found that the industry as a whole, was likewise in the red. Obviously this is a very unsatisfactory basis from which to predicate exemption under the bill. Applying the lessened capital system, it is found that the airlines are equally a loss-making industry. Total assets for the industry amounted to only about \$47,000,000 in all last year. With substantial plane acquisitions currently being made, the airlines have had to revise their earnings in order to help pay for such purchases.

The Air Transport Association has recognized this problem and its president has asked for complete exemption for the airlines from the provisions of the pending bill. The contention has been advanced that as the earnings of most of the air carriers are regulated by the Civil Aeronautics Board, there is no need to apply the excess profits tax to this group.

With complete figures available for the air transport industry's record-breaking first half, proper categorization of the airline industry as a group, Table I shows the increase in terms of percentages only for the first six months of 1940 as compared to the period in 1939. A comparison of these figures clearly shows distinct trends for all of the individual companies presented and a significant picture for the industry as a whole.

American and Eastern reflect the benefit of additional trips in service thus permitting more schedules, hence the largest increase in revenue. However, although United and TWA also registered their gains, it was to a lesser degree than American and Eastern.

The sharp increase in revenue-per-passenger miles shown by both Transcontinental and Northwest is primarily due to the replacement of smaller equipment by new 21-passenger DC 3's. The "big fave" all improved their load factors thus showing an accelerated rate of increase in revenue-per-passenger miles as contrasted with the improvement in revenue-per-mile shown the institution of the "Streamliner" in (Turn to page 111)

FOR MODERN RECONNAISSANCE

...Today's Military Aircraft need this RCA Equipment!



Location of Transmitter, Receiver and Retractable Antenna permits installation without need for ground.

Efficient, lightweight RCA AVT-15 Transmitter—simple, powerful, rugged, only 35 pounds with antenna system and accessories. Used in British Command.



3 Pounds in bulk when fully retractable antenna is in the ground—this RCA AVR-30 Receiver weighs 2,000 in bulk when antenna is in the ground.



Quickly retractable antenna system of RCA AVT-15 Retractable Antenna allows aircraft to fly at any altitude and any speed. No hand-cranked antenna retracts hand operated by pilot.

FOR rigorous service in tactical aircraft operations, today's high speed planes demand flexible, highly reliable, light yet rugged communications equipment. Here is the RCA answer—ready now for delivery from stock—available for export, and readily adapted to all types of military aircraft.

RCA AYA-41 Retractable Antenna System combines the efficiency and longer range of a long trailing antenna with the convenience and low drag of a short fixed antenna. New type of reel can be released with a flick of a switch only when flying speed is increased—preventing accidental release on the ground. Yet short range communications between units communicating on the ground need not be discontinued—so adequate short range signal is maintained even with the antenna retracted!

Both the AVT-15 Transmitter and the AVR-30 Receiver, as well as all other RCA Aviation Radio Equipment, can be efficiently adapted by RCA Engineers to meet your special and unusual requirements—no matter any conditions of military aircraft operation. For highest efficiency and flexibility in aircraft radio, with low weight and low drag, call on Radio Engineers—call RCA! Write today for complete facts and literature on the AVR-30, AVT-15 and AYA-41.

For dependability, it pays to use the radio protected by most airports and pilots—RCA RADIOSYSTEMS.

See exhibit of RCA Aviation Radio Equipment at RCA Building, New York, World's Fair—and at the RCA Sales Offices in San Francisco, California.

RCA for Aviation Radio

RCA Manufacturing Co., Inc., Camden, N. J. — A Society of the Radio Corporation of America



Air base display at Bangkok airport showing a view of the Siam Military Air Base.

AVIATION MAKES PROGRESS IN SIAM

With World Politics focusing new attention in the Far East the aeronautical situation in Siam is of timely interest.

By Lucien Zechareff author of "This is War" Associate Editor, *Aircraft Publications*

It is sometimes difficult to realize in what extent this world of ours is in the grip of aeronautics, both as war and peace, when one examines the aeronautical situation under a recent year's work and can also see the progress in Siam—also known as the Kingdom of Siam—living then in its infancy, and Siam is now Siam.

To be sure, Thailand's commercial and military aeronautics are dwarfed alongside the aviation facilities and resources of the great American and European powers. However, the flying crop there is up to the minute and

most impressive when one remembers the size of the little country and its inaccessibility (or almost so) location in geographically undeveloped Southeastern Asia.

A glance at the photographs illustrating this article will convey the idea that while Thailand, one of the last absolute monarchies, may not be the hot word politically, it has kept up with the flying progress on this planet.

Since warlike or preparations for it permeate the atmosphere of all continents, let us first survey quickly the status of military aviation in the realm. Per-

sonally known in the Royal Aeronautical Service, the Royal Air Force had been organized from the Army some time ago and is now under the direct operational command of the Ministry of National Defense. Its Commander-in-Chief is Group Captain Pina Vajiraprasit.

Although there are no more aerial bombardments in Thailand and the Air Force depends on such importance as the Curtiss Hawk, Vought Corsair, Martin Bomber and Avro 504N, there are military workshops building equip-

(Care to page 118)

A battery of transmitters and receivers at the Siam airport.



Photograph by Pina Vajiraprasit.



NATIONAL DEFENSE FINDS REYNOLDS METALS READY!

Reynolds Metals, an accredited source of supply, is ready to handle the aluminum demands of the Aviation Military Program immediately! Months ago, we readjusted our vast production facilities so that aircraft assembly lines would not be slowed down by a shortage of aluminum bars, rods, shapes, tubes or sheets. We readied our engineering staff to tackle the particular and exacting problems of aluminum as applied to aviation

and to furnish practical solutions to them quickly. Today, any aircraft manufacturer, military or commercial, will find a new source of supply and expert engineering assistance here at Reynolds Metals. He will also find skilled production facilities for the rolling or preparing of aluminum parts. We would welcome an opportunity to talk shop with you. Reynolds Metal Company, General offices, ...Richmond, Va. ...Sales offices in principal cities.

REYNOLDS METALS COMPANY

PLANTS: RICHMOND • NEW YORK • CLEVELAND, O. • KANSAS CITY
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THE *Precision* REQUIRED FOR MODERN INDUSTRY

South Bend Lathes are designed and built to provide the extreme precision required in modern industry. They are giving test room accuracy on close-tolerance production work in hundreds of manufacturing plants throughout the United States. The smooth, vibration-free belt drive to the spindle permits finish turning or boring with such precision that subsequent grinding, honing or lapping operations can often be eliminated.

South Bend lathes are made in 9", 10", 12", 15", 18" and 20" swing, in 5' to 12' bed lengths, in Motor Drive and Countershaft Drive.



SOUTH BEND LATHES

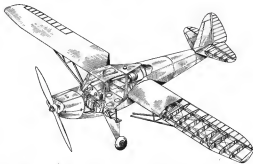
SOUTH BEND LATHE WORKS

LATHE BUILDERS SINCE 1906

181 S. Madison St., South Bend, Ind., U.S.A.

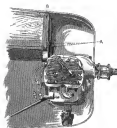


Aviation SKETCH BOOK of Design Detail



The fuselage of the Luscombe model 64 is of semi-monocoque stressed skin construction. It is built up of aluminum alloy sheet with aluminum alloy bulkheads. The fixed tail surfaces are of stressed skin construction also with metal ribs. Where one of wooden spars meet ribs with fabric covering. The control surfaces are constructed by a special process that produces corresponding parallel to the skin stress, and are of metal construction. The rest of the cabin has a slightly built in with the air tank directly behind.

The new Avenger models 10-15 and 15-25 have the new exhaust system shown at the left. "A" is the exhaust air inlet which horizontally returns a return that can be operated from the cabin. "B" is the exhaust manifold that connects to the exhaust tail pipes "C", and are welded directly to the tail pipes. "C" is the air inlet for the combustion burner wall. "D" is one of two attachment bolts connecting the engine mount.



The engine mount of the Luscombe 5A-3 is made of both metal and wood construction. The brackets "A" on the drawing at left and the views right showed the engine from the semi-monocoque fuselage construction and are designed to take the loads indicated. "B" is an end plate made up of 1/8 inch thick dural ply material. "C" are two supporting members of 1 in. by 1 1/2 in. square. Supporting on this is a 1/8 inch thick dural ply substructure joined to both plates "D" - "E" is a 2 1/2 in. by 1 1/2 in. square member and "F" is a 1/4 in. by 1 1/2 in. square member. "G" is 1/8 inch dural ply material.



The pilot's seat designed and built by the Koffler Aircraft Corp. is of 14-00 Alclad construction spot welded. The seat can be adjusted vertically along the supports "B" and other adjustments by the handle "A". The angle of the backrest before is 30 degrees. The seat has withstood a vertical downward load of 4000 lb. and was sprung the back of the seat of 1155 lb.



The head wire gun bracket built of the Shurtz 1117 Aluminum Gun Bracket was made of 1/2 in. 303 stainless steel gun, stainless steel and 1/2 in. aluminum. Gun line through 30 in. when mounting bracket load gun and loading wire and the unit varies down to 30 in. between the gun bracket to according to the requirement.

Aviation RADIO

Dialing the Air Waves with Don Fink



Transmitter-Receiver

The latest trick in making battery-operated transmitter-receivers easy to use is that announced by Taylor Telephone Products of the Long Beach, Calif., Airport. The standard Model BR-4 receiver and RT-4 transmitter have been mounted in a lightweight carrying case providing one of the most portable radio devices. The control panel at the top of the case permits tuning over the receiver battery band, (700 to 430 kc) and the transmitter band, (400 to 300 kc) and an all switch. A battery is indicated by a flashlight lamp. The power output



Taylor's pick-up transmitter-receiver.

with standard batteries is 1 watt, but 1-watt operation may be obtained with two sets of batteries. The push-to-talk button on the microphone permits all receiving operations. The range is 25 miles when used with an adequate trailing antenna. The weight is 12 lb. for single battery operation, 17 lb. for the double battery type. Standard battery life exceeds 100 hours. Two phone pads are available, with efficient indications however them to make the work easier in station assignments or for communications. The crystal unit is furnished in 1,185 kc., but other frequencies are available on order. The cost is \$150.

This equipment, with no engine carrying cost, should be of special interest to the private plane operator not wishing to go into heavier size

U-h-f Equipment

Two component parts of equipment for u-h-f communications have recently been announced by Radio Telephone Co. The Model 422 transmitter is a table unit for airport radio station. The frequency range, 128 to 132 Mc. has been modified with a power output in excess of 100 watts, capable of 100 per cent amplitude modulation. The audio frequency characteristic is the entire 3 db from 180 to 4,800 cycles, and the distortion at 400 cps is less than 5 percent up to 95 percent modulation. A "take operator" switch is provided to lower the plate voltage during preliminary tuning adjustments, to permit tubes and components for excessive currents. The transmitter operates directly from a (115-volt, 60-cycle line, and is housed in a single steel cabinet 75 in. high, 24 in. wide and 36 in. deep.

The series 444 u-h-f receivers are intended for airport traffic control and for general communications purposes. Three levels are available in different models: 66 to 66.5 Mc., 123 to 124.5 Mc. and 140 to 144 Mc. (the voice action of the Federal Communications Commission in changing the band from 60 to 96 Mc. is reflected in the re-

vised frequency of the last model band). Model 424 can be supplied with the first two bands, Model 424A with the second, and Model 424B with the last band. The receiver in each has 300 milliwatts output is produced with 5 vacuum tubes, 30 percent modulated, with 10 db signal-to-noise ratio. The selectivity is 3 db down at 40 kc. band width and 60 db down at 200 kc. Image and spurious responses are down 60 db. The audio output, 5 watts maximum, covers the range from 120 to 4,800 cps within 3 db, and the a-v-c holds the output constant within 3 db from 500 microvolts to 100 millivolts. Three Type 901 wave tubes are used in the u-h-f circuit, and a total of fourteen tubes is used in all, including a voltage regulator tube. The net weight is 77 lb. The receiver is mounted for rack and panel mounting.

WAL 5-kw Transmitter

The most powerful surface ground station transmitters yet used in this country, having a power output of 5 kw, are being installed for United Airlines by the Federal Telegraph Co. These units are to be installed at LaGuardia Field, New York; Chicago, Cleveland, Denver, Los Angeles, Oakland, Portland and Salt Lake City. Each transmitter is built to face to six sections, including power supply, modulator, air-flow, and two or three v-f units. The frequency range covered is from 2,000 to 15,000 kc. Amplitude is employed in all the transmitting tubes, and the segment is arranged for full accessibility from the front panels so that no inside space is needed at the rear.



WAL 5-kw ground station installed by Federal Telegraph.

Already Enlisted for Hemisphere Defense

Back when "Hemisphere Defense" was a mere implication of the Monroe Doctrine, Ryan STM primary military missions were doing precision service in the air forces of Mexico, Guatemala and Honduras. As soon as "Hemisphere Defense" became a ringing challenge to the U.S.A. these modern metal low wing trainers were enlisted in the U.S. Army Air Corps. Constantly being applied in increasing numbers Ryan play on ever more important role in the Army Civil Training Program. Ryan Aeromarine Company, Lindbergh Field, San Diego, California.

CONTRACTORS TO THE U. S. ARMY AIR CORPS



As the favored primary military trainer, Ryan STM is the warplane marriage of many progressive nations.

BUYER'S LOG BOOK

What's New in Accessories, Materials, Supplies, and Equipment

Decreased weight with increased efficiency are the chief features of the new Model 437 hand pump announced by the Pump Engineering Service Corp., Cleveland, Ohio. A saving in weight of 38.5 percent has been made over previous equipment through the use of aluminum alloys and by simplification of design. This model is supplied for emergency service only and not for continuous operation. It weighs only 23 lb. and is designed to supply fluids at pressures up to 1,500 lb. per sq. in. Displacement is 6 cu. in. per stroke, or 16 cu. in. per cycle.—*Aircraft*, September, 1949.

Capable of measuring gasoline or fuel oil consumption down to the 1/100th part of a gallon within an accuracy of 1/10th of 1 percent, a portable piston meter has been perfected by the Precision Meter Co., Portland, Ore. It can be used during actual plane operation, or during block testing, to determine fuel consumption. A control switch permits instant starting or stopping of measurement without interfering with continuous supply of fuel to the engine. Each 1/100th part of a gallon is electrically recorded on a dial, while fractional parts are readable by 1/1000th on a translucent measuring cylinder.—*Aircraft*, September, 1949.

Known as the low-voltage testable (D-Tels-The-Tels) pocket meter, a new product of Lafayette, Inc., Chicago, Ill., is finding wide application for checking current and circuit radio elements. Designed to cover a range of 3 to 25 volts a.c. or d.c., or secondary to 50 volts, the device has clipper type tips and a high temperature coefficient lamp housed in a transparent plastic case.—*Aircraft*, September, 1949.

Developed to provide a compact, self-contained airplane fueling system for maximum safety, the "Serve-a-plane" airport service station offered by S. F. Bonser & Co., Inc., 25 Wayne, Ind., should find wide application on existing fields, and new airports to be built under one expanding air program. The standard Type 20V Serve-a-plane unit is a beautifully finished cabinet, with charcoal trim, ready to set on a concrete base, and incorporating all the usual service requirements for fuel, lubricating oil, windshield cleaning, tire protection, etc. Pump capacity is 15 to 20 gal. per minute and the flow is second by gear. Complete equipment of the standard Serve-a-plane unit includes: Cabinet, fueling unit, strainer and air release, water separator, Austin Meter, sight glass, power-driven hose reel, 100 ft. of 1 in. aviation hose, nozzle, two shovels for skimming oil, windshield cleaning equipment, sales slips, etc., electric switch and light for night dispensing, operating for 3-1/2 hr. continuously.—*Aircraft*, September, 1949.

Making satisfactory plastic tube joints, especially under conditions of high pressure or extreme vibration, is simplified through use of the Eterna safety tube and pipe coupling manufactured by The Wheelabrator Co., Cleveland, Ohio, who are sole American distributors for the French development. The Eterna safety fitting is quite simple. A plastic tube is inserted in the coupling and the nut is tightened with an ordinary wrench. This action forces a hardened ring, or sleeve, to draw itself into the outside surface of the tube. The resulting joint has a strength heretofore considered impossible for tube connections and is especially satisfactory for high-pressure hydraulic systems, although equally applicable to low-pressure lines. Joints of any type of tubing material can be made, and not limited under any, may be assembled quickly, and may be dismantled and re-assembled an unlimited number of times without replacement of any parts.—*Aircraft*, September, 1949.

An indication of the rapidly with which scheduled air transportation is developing is found in the production of a trailer designed specifically for airport work. Such a trailer is the Oliver "2P" airport trailer, built by the Oliver Farm Equipment Sales Co., Chicago, Ill., and which is now in use by TWA, Mid-Continent, Delta, American, Pan-American, Central Airlines, and numerous airports. These streamlined but powerful little machines are readily the heaviest



Power handoperated hydraulic pump



Machine with cylinder



Tireline trailer



Semi-airplane loading system



Valvehead engine



Oliver "2P" airport trailer



Semi-airplane loading system



Grab metal band saw

equipment on the field. They are the "big boys" of aviation and, in addition, perform dozens of odd jobs, such as moving the grass and weeds, pushing snow, plowing in clear runways, pulling grading equipment, etc. The Oliver "2P" has electric lights, oil burner, incandescent capes, sheet towing radius, differential steering levers, and numerous fittings and accessories to adapt the machine to all airport work.—*Aircraft*, September, 1949.

An explosion-proof quick switch of unusually compact dimensions is now offered by the Metro Switch Corp., of Proctor, N.J. Measuring 1 1/2 by 2 1/2 by 1 1/2 in., the switch is listed by the Underwriters' as suitable for use in atmospheres containing vapors of ethyl ether, gasoline, alcohol, acetone, kerosene, and other flammable gases. A removable cover plate provides easy access to the rapid terminals. The switching unit is at a standard position with switch with a rating of 1,200 watts up to 600 volts a.c.—*Aircraft*, September, 1949.

An improved model 18-in. throat metal band sawing machine has been announced by Crab Brothers, Griffin, Wis. Such machines have now become standard in practically all aircraft factory and shops and are playing a big part in spending production. The new Crab, Model 18-18, has a complete welded steel frame, a heavily ribbed cast iron table, ribbed bar work, a built-in cabinet for tool storage and other improvements. Optional features include automatic hydraulic table feed, light attachment, air blower, circular cutting attachment, measuring glass, and torchometer.—*Aircraft*, September, 1949.

Born to aircraft maintenance shop is the new flexible spanning machine for winging design in flexible radio shelling combat, first is now offered by the American Metal Hose Branch of the American Brass Company, Waterbury, Conn. Employing the principle of double heading, the machine is small and compact, is designed to attach to the work bench, and is manually operated. The whole operation of stretching flexible to conduct requires less than a minute.—*Aircraft*, September, 1949.

Featuring an eight-sided scale selector the Model A-128 instrument testing instrument developed by The Mettler Co., Cleveland, Ohio, checks accuracy of altimeters, air speed indicators, rate-of-climb indicators, fuel pressure gauges, manifold pressure gauges, actuating gauges, etc.—*Aircraft*, September, 1949.

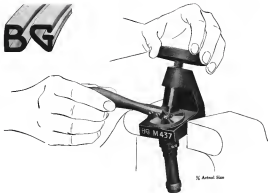
A new auxiliary power plant unit for airplanes has been announced by Leontine Engineering & Research, Linden, New Jersey. The power supplied by this unit at its level is a continuous output of 5 kw. or an output of 7.5 kw. for a period of five minutes. Such low high altitude operation also the unit is capable of producing 2.9 kw. continuous output at 20,000 ft., all current being 24 volts. The model number of the new unit is A-20-24 and its dry weight is 120 lb. The generator is driven by a two cylinder opposed air cooled motor which runs at a constant speed of 4,000 rpm. The unit is already in use on many military airplanes.—*Aircraft*, September, 1949.

A major method of airplane house construction has been developed by R. G. LeTourneau, Inc., of Texas, Ga. A not larger, 82 ft. square, constant air pressure form house. The sole with air-supplying unit and lay, in fact, support the roof. The structure consists of air and steel, all covered with 24 in. piers in a uniform panel design, and then welded together in piers. These piers are, in fact, welded in supporting panels to form a wall, floor, or ceiling. For installation purposes rock used is forced into each pier to a density of 16 lb. per cu. in.—*Aircraft*, September, 1949.



R. G. LeTourneau, Inc., airplane house

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aviation

NEWS

RAPID TURNFIELD,
Washington

C. F. McElroy,
Piedra Vista

Joe P. McElroy,
New York

E. B. Linder,
New York

SEPTEMBER 1948

Right: History in the making. In the rear of the car, left to right, are Presidents Roosevelt, Prime Minister Mackenzie King of Canada, King of the West Indies. They are reviewing 127 U. S. battle planes at Wright Field, N. Y., during the war games, and discussing a North American defense plan, whereby U. S. and Canada act together to establish air bases.

Lower right: President and suite jumping at Wrightstown, N. Y., where men from the U. S. Infantry School at Fort Benning, Ga., are going through a course of jumps. Unlike the white jumps at the World's Fair, these had heavy soles. The 127 U. S. planes. Top view of the lower can be rotated, permitting slide to drift away from the base.



The Industry and Administration Reach Agreement Start Huge Airplane Building Program

Washington (AVIATION NEWS)—After weeks of negotiating and uncertainty, aircraft manufacturers finally decided to sign an order for production of most of the 4,200 plane program for which money was provided in the last defense appropriations. Some 140 groups of orders can be handled without substantial plant expansion, the industry agreed in an accord without waiting for enactment of the reauthorization and authorization legislation.

North American Aviation, Inc., was the first to sign, under an award of \$1,225,000 for 100 trainers. Within a few days Fairchild Engine & Airplane Corp. received a contract for 100 trainers costing \$1,609,386, with Consolidated Aircraft Company awarded \$1,111,512 for production of 50 four-engine bombers. The following day, Beach Aircraft Corp. signed up for 27 training planes at \$1,018,746, and Doney's Aircraft Division for 121 trainers, totaling \$1,141,645. Some half-hour additional negotiations pending at Wright Field were expected to be completed before the end of the month.

It is complete had the hold-up in production from 2000 for some weeks after money was available, contracts were set for only 25 planes. Early in July the decision had been reached as to what planes would be built by each manufacturer, and the manufacturers had been notified of their allocation. However, the administration and Congressional leaders had announced that Vought-Triplett and other restrictions would be lifted and authorization of new facilities permitted over a five-year period. The administration, however, insisted that these changes be incorporated in our present reauthorization measures which everyone knew would take months.

Early in August, at a hot meeting of manufacturers with Defense Commission and military officials, agreement was reached in principle on going (This is page 67)



NATIONAL Aviation

Gravelly Point Progress

Does the Pentagon's push into the jet engine marketplace mean more and more Gravelly Point national airports. That way, about \$1,000,000, will be ready for use in late October, when the jet engine will be taken into service. The date of beginning of the jet engine is not yet known. There will be an air launch, but a bill is before Congress for a jet engine to be used. The jet engine of the down line, which is being taken into service, will be taken into service. The jet engine of the down line, which is being taken into service, will be taken into service.



Left: Jesse Mc. was awarded the Wright award, by General P. Warren, right, at the dedication of the new Wright Memorial at Dayton on Aug. 16.

There is a lot of work to be done in the north-west region. Some of the most serious work will be done in the north-west region. Some of the most serious work will be done in the north-west region. Some of the most serious work will be done in the north-west region.

the shorter time. Similarly, if the Secretary of War or Navy makes that a particular facility is no longer useful for national production, it may be dismantled over a period during which it was useful. These provisions now apply to Navy, buildings and facilities of equipment, installed after July 10 of this year. The administration is studying a change which would make the date Jan. 1, 1946.

Major construction at the field here has been awarded to Jacobs Brothers, of Buffalo, when the field was to be built. The field was to be built. The field was to be built. The field was to be built.

The eligibility for rapid construction, facilities must be certified by the Defense Commission and the Army or Navy.

Amortization Speeded But Profits Taxed

Washington (Continued From Page 1) The last amendment to the legislation has a long way to go before it reaches the President's desk, and some changes in the original draft are already in the air. The bill would be amended to provide for the amortization of plant, but not equipment, over a five-year period, and would tax the "new producer" at a rate ranging from 25 to 40 percent.

The bill would authorize the use of supply bonds in computing the net income of the taxpayer and ordinary income tax. The period of amortization may be changed if the emergency is determined by the President in less than five years the amortization may be re-adjusted retroactively over

the shorter time. Similarly, if the Secretary of War or Navy makes that a particular facility is no longer useful for national production, it may be dismantled over a period during which it was useful. These provisions now apply to Navy, buildings and facilities of equipment, installed after July 10 of this year. The administration is studying a change which would make the date Jan. 1, 1946.

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The bill would authorize the use of supply bonds in computing the net income of the taxpayer and ordinary income tax. The period of amortization may be changed if the emergency is determined by the President in less than five years the amortization may be re-adjusted retroactively over

into which excess profits have to be turned.

The excess profits to be taxed in the difference between actual earnings and a theoretical maximum profit based on earnings during a base period (1938-40). Leaving out one individual, it would about 100,000.

A corporation which during the base period earned less than 5 percent on its first \$100,000 of invested capital and 4 percent on the rest would be considered "excess" entitled to three exemptions on the capital with which it entered 1940 (one on investment in newly located capital).

A corporation earning a greater return than this during the base period but less than 20 percent would be allowed the same return during the five years as during the base period.

Normal returns of a corporation which earned more than 20 percent in the base period would be taken as being applied to the average dollar earnings in the base period plus a 4 percent on net investments.

New corporations would be allowed 4 percent on the capital with which it entered 1940 plus a percentage of borrowed capital ranging from 4 to 10 percent depending on amount.

Women's Clubs Growing

The "Minsky Club" is an international organization of women. The club, which is based in New York, has a large number of members. The club, which is based in New York, has a large number of members.

held office in Washington. Miss Grace Hamilton is in charge of the D.C. office and also does work for N.A.A. Betty Gilman, president, is not coming to Washington. The Minsky Club now has 180 members, but to have 1,000 by the year-end. Headquarters keeps employment, and the club is planning to have three offices in New York, in Cleveland and public relations work, an industrial division, and a Good House for job employment with industrial experience.

A new women's organization, known as the Women's Club of America, is planning rapidly in the East. It is a national group, not competing against the Minsky Club, which is an organization of women. The Women's Club of America is planning rapidly in the East. It is a national group, not competing against the Minsky Club, which is an organization of women.

Leaders of women's flying groups may they do not expect to fly, and they are planning to be permitted anyway, but they believe they can attract and form flying groups, which may be for women's use.

Now It's 50,000 Pilots

Washington (AVIATION) The 50,000 pilot program of CAA is judged by many people to be a big success. The program is judged by many people to be a big success. The program is judged by many people to be a big success.

The plan is to train 50,000 pilots by next June 30. The program is judged by many people to be a big success. The program is judged by many people to be a big success.

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Ground school training started in 400 colleges, and 120 more students, at the same time, started. Such training is being done in 100 schools, and 120 more students, at the same time, started.

The year about 5,000 pilots will be trained in 1940. The year about 5,000 pilots will be trained in 1940. The year about 5,000 pilots will be trained in 1940.

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United Aircraft Plans Large Expansion Program

New from the direction of Hartford, Conn., reports that Pratt & Whitney and Hamilton Standard, Pratt & Whitney and Hamilton Standard, Pratt & Whitney and Hamilton Standard, Pratt & Whitney and Hamilton Standard.

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CIO-WAN Organizes Plane Division

An authorized drive to large aircraft workers into CIO's United Auto Workers Union is being organized. An authorized drive to large aircraft workers into CIO's United Auto Workers Union is being organized.

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THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

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NEW AIRPORT PROGRAM

C.A.A., War and Navy officials are working on a program to build new airports. C.A.A., War and Navy officials are working on a program to build new airports.

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For faster, lower-cost dimpling or riveting on production lines . . . two new CP Stationary One-Shot Riveting Hammers. . . CP-211 Hammer uses the standard CP-209 One-Shot Hammer (capacity, 3/16" Dural Rivets). . . CP-212 Hammer uses the standard CP-207 One-Shot Hammer (capacity, 1/4" Dural Rivets). . . Write for Supplement "A" to SP-1851, and SP-1851, covering complete line of CP Aviation Tools.

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Cylinder



Lock for
Extended
Landing Gear



Lock for
Retractable
Landing Gear



Retractable
Landing Gear
Cylinder

Tail Wheel
Cylinder

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CLEVELAND, OHIO, U. S. A.

Aviation PEOPLE



A. WARD KIMBLEY, for the past 11 years connected with the Engineering Department of the Air Corps, Jones Bernard Aviation Equipment Co., as vice president in charge of sales.



JAMES G. HALL has been elected vice president & chairman of the executive committee of Bank of America Corp. He holds several flight records and has engaged in varied business activities.



EDWIN E. ALDRIN has been appointed special consultant to Gen. G. M. Connolly, Administrator of Civil Aeronautics, to advise on airports, airways, pilot training, and technical development.



NEW POST at Air Traffic Executive created by Bellamy Express Agency will be filled by Joseph M. Stenaghy, who will direct, develop and coordinate air transport and rail services.



NEW MANAGER of Lockheed Aircraft's service department is Reagan Boswell, veteran airline maintenance expert, and for the past year in charge of inspection & service for Mesa Airlines in



GEORGE W. LESCHER (l) and DONALD W. WEED have been appointed respectively executive engineer and assistant executive engineer of Nuclear Air Station Corp. They will direct the administration of the engineering department in connection with Alexander Kartveli. Lescher has been serving as senior executive engineer. Weed was project engineer on the Air Corps contracts.



ROBERT H. HIRCKLEY (3) former chairman of C.A.A., trustee from Harlem Branch, present chairman of C.A.B., nomination passed by members of C.A.B. in "acknowledgment of the valuable services rendered by him to the advancement of American civil aviation, and the personal pleasure which the members of the Board have derived from their association with him."



EDWARD J. NOBLE, first chairman of GAA, has resigned as Under Secretary of Commerce to work for studies at WEFA. Noble's possible interest is in national defense, not Sweden.



CHANGES in the executive sales force of Lockheed Aircraft Corp. have been announced by W. R. Carl S. Butler, (l-r): Joseph A. Margrove, in charge of domestic sales; William G. Hill, in charge of foreign sales; and William A. Boush, in charge of the defense sales department. Mr. Butler is president of Lockheed Aircraft Co. Mr. Hill is in charge of domestic sales and project engineer for the Army XX-15, in main manager of the export sales department; Charles F. Thomas, sales analysis, structures group engineer and project engineer, is appointed technical sales engineer.



G. M. WEAVER has joined the staff of Boeing Aircraft Co.'s Maintenance Dept. For the past six years Weaver has been superintendent of maintenance for United Air Lines at Chicago.



LOUIS H. SMOS is now assistant chief engineer at the Curtiss Propeller Division of Ciba, N. J., and C. W. Chilless heads the research engineering section.



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AGAIN... A BOEING FIRST! Continuing the supremacy of BOEING 4-engine aircraft, which began with the development of the mighty Flying Fortress for the U. S. Army Air Corps, BOEING now steps forth as the first airplane manufacturer to provide 4-engine commercial air transport for passenger lines enclosing two-thirds of the globe. From London to Hong Kong, the new standards of luxury, speed and reliability for which BOEING 4-engine airplanes are famous are now

available to air travelers. For more than a year, giant 43-ton Boeing-built Clippers have been flying the Atlantic and the Pacific on Pan American Airways' routes. Transcontinental & Western Air, Inc., recently completed the great 15,000-mile run by inaugurating 4-engine Boeing Strato-liners on their established coast-to-coast route. In addition, Pan American Airways are now using Boeing 367 Strato-Clippers in unexcelled service to the de Havilland

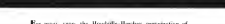
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Fighting Ships Still For Brits

United Aircraft Associates

Unfilled orders of the prime plane producers are steadily rising and are now well over twice the \$300,000,000 estimated aggregate backlog at the beginning of the year. Controls in regulation under the

United Aircraft Associates

Charles J. Marks, Arthur A. Murry, Frederick L. Woodcock have been appointed chief engineers respectively for United Aircraft, Pratt & Whitney and Hamilton Standard. Marks has been production engineer with Pratt & Whitney since 1939; Murry mechanical production engineer since 1940; Woodcock in charge of tool designing at Hamilton Standard since 1936.

Defiant orders of the primary plane producers are steadily rising and are now well over twice the \$200,000,000 estimated aggregate for all of the beginning of the year. Contrasts in negotiation, under the



defense program will increase the grand total by another \$200,000,000. For example, the Army Air Corps is understood to be negotiating a large order with Curtiss-Wright which would increase the

unfilled orders to better than \$100,000,000. As it is, Carter Wright's \$200,000,000 backlog is slightly in excess of late shipments by all apparel makers in 1939. The following table gives the latest approximate unfilled orders of fifteen railway companies.

[illegible]

202-898-0000

Boeing's airplane engine, which he is working independently, will be of about 1,500 hp and will be based on the design of the Lincoln-Beyler V-12.

Auto Club of Iran has bought 20 Bascom Climacter 180-hp trainers, and plans are being made to manufacture Climacter in Iran.

Wetter, Stienen, Merz

Manufacturing facilities, as well as the new Nashville plant of the Stinson Division of Avco Aero Manufacturing Corp., will be more largely devoted to production of military trainers through a re-shuffle of Avco's Corp. subsidiaries under which Valley Aircraft will take over Stinson. Valley's entire program experience has been in the military field.

Stinson's Nashville plant now devoted to Stinson 140 and a few military trainers is planned, under the new arrangement, to triple or quadruple the size of the Nashville plant, somewhat increasing the output of commercial planes as greatly enlarging the training output. The old Stinson plant at Wayne, Mich., will be used for parts.

Valtes, until last spring, was wholly owned by Aviaton Corp., which also owns Aviaton Manufacturing Corp. At the time the Valtes holdings were reduced to 49 percent, 75 percent (and involves an increase in Valtes stock which will result in Aviaton Corp. owning about 75 percent of Valtes, directly or through Aviaton Manufacturing Corp.

Boeing Aircraft plans to spend \$20,000,000 on a huge new plant in Long Beach, Calif., and also make immediate additions to its Santa Monica and El Segundo factories, all of which will accommodate output sufficiently to complete new Army and Navy

New machinery for these plants has already been purchased. Donald Douglas, president stated that the expansion would result in more than doubling present personnel in payroll. The company employs 18,000 employees more than \$18,000,000 annually.

Science Pump Co., now with a headquarters, plans to increase its output of concrete pump and also expand into other pump-using industries.

Proton Turkey as president. The company, which is also involved in combat arms exports, is organizing an export team department headed by Ayhan C. Levent.

TWENTYFIVE YEARS WITH ONE COMPANY (Carlisle Area plant Division of Buffalo) earns for design engineer Stuart T. Payne (C) a diamond retirement pin, presented by Barville S. Wright, vice president of the division. Veteran Payne joined the corporation in the 1950s "labor" class.

Ally	Sp. 1991
Arabian City	1,000,000
Bah	1,000,000
Bahrain	1,000,000
Bombay	1,000,000
Calcutta	1,000,000
Chennai	1,000,000
Colombo	1,000,000
Dubai	1,000,000
Hyderabad	1,000,000
Jaipur	1,000,000
Kolkata	1,000,000
Madras	1,000,000
Mumbai	1,000,000
New Delhi	1,000,000
Patna	1,000,000
Rajkot	1,000,000
Surat	1,000,000
Varanasi	1,000,000

Boeing's airplane engine, which he is working independently, will be of about 1,500 hp and will be based on the design of the Lincoln-Beyler V-12.

Asia Club of Iron has bought 2000 **Chenille** 180-kg trainers, and plans are being made to manufacture **Chenille** in Iran.

Consolidated Expends

Editor's Note: The following summary of Consolidated Aircraft Corp.'s activities in the national defense program was prepared for the Air Corps and is published for the information of other manufacturers.

"Consolidated Aircraft Corp.'s position relative to the national defense program calling for \$2,000 plane output per



Meyer Plant

year, is one of timely absorption. Our present expansion program by which our factory is being doubled, was already under way before the announcement. Completed, this expansion will give us 1,500,000 sq. ft. of covered and unroofed manufacturing space, making it, believe, the largest integrated aircraft manufacturing plant in America, and we have in operation an additional land interest, equal to 80 percent of this area, with plans for a practically complete lot for possible expansion. We have a factory of our own in good operation—equal to any in our industry—this best in its class, and in operation as we present as our factory.

My brother-in-law, Mr. Paul Beardsley E. Plant, president and manager, Consolidated Aircraft Corp.

West Coast News

Aircraft Parts Manufacturing Association has been formed in Los Angeles, Calif., for the purpose of collecting, analyzing, and disseminating information of interest to its members, particularly relating to production and through the assistance of new information affecting manufacturers and aircraft parts suppliers. Membership includes California companies manufacturing or producing parts, accessories, or products used in the aircraft industry. Jack Frost, former secretary

Walter B. H. Plant, Consolidated Aircraft Corp., is serving as executive secretary of the new association.

An important addition to the Southern California aircraft industry is the formation of the Southern California Aircraft Manufacturers Association, Glendale, Calif., formed by a group of aviation industry executives to regulate the manufacture of aircraft parts and accessories as a substitute for government control. The association, which, and from these plants into various branches. Officers and directors of the company read the Air Corps' list of aviation manufacturers. The association is headed by Lawrence Green, secretary and treasurer, and Hall S. Hildner, president. The three named officers also serve as directors plus the following directors: William E. Klemm, president of the Southern California Aircraft Association, Richard W. Wilson, president of Vought Aircraft, Inc., John K. Northrop, president of Northrop Aircraft, Inc., Charles H. Van Dusen, vice president and general manager of Consolidated Aircraft Corp.

Sub-contractors are invited to the plant in order to build the plane. The plant is located in the Los Angeles area, near the Los Angeles International Airport. The plant is a single-story building with a large hangar. The plant is a single-story building with a large hangar. The plant is a single-story building with a large hangar.

Ford Offered P & W License

Frank B. Whitney Aircraft has offered the Ford Motor Company a license agreement which Ford will produce P & W double-engine Wings after a testing program. The license is for a period of five years. The license is for a period of five years. The license is for a period of five years.

At the wing Ford has not issued a contract, but indicates that the deal will go through. Ford is to pay \$1 million for the license. The license is for a period of five years. The license is for a period of five years. The license is for a period of five years.

Albion Engines is apparently contemplating new wing orders as it is buying back the plant equipment.

Manufacturers Not At Fault For Delay

Statement of top-ranking Army officials before the Senate Appropriations Committee also shows aircraft manufacturers have blame for the delay in signing national defense contracts.

Although General Arnold, Chief of the Air Corps, was recently quoted as saying "They were not at fault" at this point," he also said, "They are not actually behind them going ahead. Some of them just break through and others are in the fact that they do not have orders, have not in raw materials and started the manufacturing of just this day. I think the industry is ready to go ahead when it is a straight-up order."

Ever Gen. George H. Brett testified that "The industry has been playing hard on the government and they have lost money in doing it at times." "Financial problems faced by the industry, such as in the case of the Vought-Tenison plant, have been a serious problem. The industry has been a serious problem. The industry has been a serious problem."

Building has been a problem for the industry. The industry has been a serious problem. The industry has been a serious problem. The industry has been a serious problem.

Location of Plants

The War Department's idea of location of plants and airports is a serious problem. The industry has been a serious problem. The industry has been a serious problem. The industry has been a serious problem.

Shoreman Division is advancing PT-58 primary program to the Air Corps for the purpose of testing the plane. The plane is a PT-58 primary program to the Air Corps for the purpose of testing the plane. The plane is a PT-58 primary program to the Air Corps for the purpose of testing the plane.

Mexico Speeds Production

Editor's Note: The following statement by the president of the Mexican Manufacturing Co. was received too late to be published last month with the statements of other manufacturers.



A. E. Shelton

Engine per making day, starting in the fall. The Cuban also considers the new plant facilities which will be completed in October to early January. It will be possible to give three shifts and working nearly 100 engines per month with present equipment and the expanded facilities now being provided for.

"In the event there is a need for additional engines, we will have plenty of available ground space to further expand and increase our plant facilities. It is our intention to produce of obtaining the necessary additional machine tools to provide further quantities of engines may be necessary. We have no fear of not being able to meet the contract."

"Mexico, president, Mexican Manufacturing Co."

Shoreman Division is advancing PT-58 primary program to the Air Corps for the purpose of testing the plane. The plane is a PT-58 primary program to the Air Corps for the purpose of testing the plane. The plane is a PT-58 primary program to the Air Corps for the purpose of testing the plane.

DESPATCH STREAMLINED Furnaces and Ovens



Despatch Streamlined Tackling Oven Recently Installed in a Large Aircraft Plant

for the Aircraft Industry

Despatch is doing for the aircraft industry what it has done for 25 years in other industries.

Each plant in Aircraft Engineering Co., Baltimore, Md., Despatch Oven Works, Dallas, Texas, American Iron Works, Buffalo, N. Y., Despatch Oven Works, Chicago, Ill., Despatch Oven Works, Des Moines, Iowa, Despatch Oven Works, Des Moines, Iowa, Despatch Oven Works, Des Moines, Iowa.



OVENS The Tackling Oven for Gun Soling: For heating before tank testing. For heating before and after tank testing. For heating before and after tank testing. For heating before and after tank testing.

FURNACES For food storage and storage. For food storage and storage. For food storage and storage. For food storage and storage.

DESPATCH OVEN COMPANY

OVENS—OVENS—FURNACES—HEATERS

630 Ninth St. S. E. MINNEAPOLIS, MINN.

Building Program

(Continued from p. 68)

about, but the industry was not divided on the wisdom of the move. These words have been heard in the industry.

An exception to the trend was to present a picture of the industry. The industry was not divided on the wisdom of the move. These words have been heard in the industry.

The Senate Appropriations Committee, which has approved the House-passed second Supplemental Defense Appropriation, which would provide \$100,000,000 for the purpose of testing the plane.

Production of these planes, however, stilling process even of manufacturing. The industry was not divided on the wisdom of the move. These words have been heard in the industry.

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\$100,000 in cash and \$100,000 in contract authority for engine, tools, production, and other equipment for Naval aircraft. \$100,000 for outfit for engine, tools, production, and other equipment for Naval aircraft. \$100,000 for outfit for engine, tools, production, and other equipment for Naval aircraft.

The Senate Appropriations Committee, which has approved the House-passed second Supplemental Defense Appropriation, which would provide \$100,000,000 for the purpose of testing the plane.

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Spot Checking

Among the new engines on the Douglas B-24, the bomber that has been selected as much to test for aerial power. The engine will be in the B-24, the bomber that has been selected as much to test for aerial power.

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Through transcontinental shipping service has been established on United Air Lines and Western Air Express between the East and Los Angeles.

New Lockheed Interceptor travels 440 mph at two-thirds throttle and 500 mph with open throttle in 1100 mile climb. The plane is a Lockheed Interceptor.



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Aviation ENGINEERING

Pratt & Whitney Celebrates Its 15th Anniversary

On August 1, the Pratt & Whitney Aircraft Division of the United Aircraft Corp. completed its 15th year of successful operation. No one in the industry could be considered at the tremendous contributions that this company has made to aviation during that time and to its rapid growth which has brought it to one of the largest manufacturing units of today. The company started in 1918 when three men—W. D. Knott, chief, D. L. Brown and G. J. Madsen—first met, designed and constructed a 400-hp radial engine, seventh engine for the Bureau of Aeronautics of the U. S. Navy. With a maximum



NIGHT VIEW OF THE PRESENT PRATT & WHITNEY PLANT which now has over a half million square feet and costs \$25,000,000. New addition under construction adds 10 per cent; new shops.



DOWN THE ASSEMBLY LINE showing a line of 4000 more power airplanes ready to be shipped and after their test run.

factory at East Hartford, Conn. had just been completed. The structure covered 400,000 sq. ft. of floor space and employed 5,300 workers. At present the Pratt & Whitney plant covers more than a million and a quarter square feet of area and employs over 18,000 men and women daily in three separate shifts.

Through the development of the engine, we find that in 1918 Knott and Madsen had the first successful 14-cylinder, two-row, air-cooled engine in America, known as the Twin Wasp and its brother the Twin Wasp Jr. The horsepower of these 14-cylinder engines was increased to 1,000 in the 1920's and 1,500 by two 1925 was developed. In 1935 came the first successful 18-cylinder design when P. & W. completed the development of the new 18-cylinder, two-row engine known as the

Double Wasp. After completion of this development, the engine was rated at 1850 hp, but has since been increased (the figure being withheld by the Army).

Early in 1939 Pratt & Whitney Aircraft expanded its factory adjacent to its own additional production capacity with the new 18-cylinder engine. When Alcoa aluminum supplemented that of our own country, a factory addition was created which brought the production of Pratt & Whitney engines to 584,000 by a month. Construction of this factory was undertaken at such a pace that the first machine was in operation three months after the ground was broken in October, 1939.

With their important participation in the National Defense Program, extensive plans

(Turn to page 47)

TO Produce TAKES Background



Person working on a mold from which many more of the fuselage cylinder heads used in American aircraft engines.

In these great plants scenes like that in the illustration above are taking place, as Alcoa Aluminum flows into the mold inside to make parts used in the aircraft industry. The most familiar of these parts is the three-finned cylinder head, but equally essential are scores of small fittings and other parts, all made because they are turned out in quantity with still which makes them strong and reliable.

The background of this factory operation is many years of painstaking, unerring development. The whole technique of making the thin, closely spaced fins of the cylinder head had to be engineered for the purpose. Then adapted to a mass production method. To improve further practice and the finished product, in the case of these and other Alcoa Aluminum castings, the use of the X-ray as a quality tool was pioneered. Other

stages of progress have covered mold design, temperature control, atmosphere control, and development of alloys.

Once developed, this knowledge and skill has been disseminated, and is being used by other manufacturers who cast Aluminum Alloys into parts essential to aircraft production.

This demonstrates again how there has been more than global progress; there has been a hard-headed program consistently followed to provide the aircraft industry with the products it needs made from Alcoa Aluminum Alloys. This program has contributed to the solution of the industry for mass production. ALCOA COMPANY OF AMERICA, 3102 Gulf Building, Pittsburgh, Pennsylvania.



Some of other parts are produced by casting them directly into the mold. The finished part is shown below.



THE NEW CONSTRUCTION now being built will be finished in a few months and production going to the first of this year.

A more detailed story of the recent activities of the Pratt & Whitney Aircraft Division of the United Aircraft Corporation is given in other parts of the News Section. When the opening of the two companies for defense needs was being completed, officials from the Ford Motor Company visited Pratt & Whitney to look over the facilities and make business arrangements. Upon the return of Charles M. Gorenson, General Manager of Ford Motors, he was highly impressed with what he had seen in his visit. His remarks were as follows:

"From our observations we found that the production of Pratt & Whitney engines fits in perfectly with our production and we will inform the government that we will accept a contract. . . . We greatly appreciate the cooperation received at United Aircraft. I never saw such an accomplishment in plant facilities as United Aircraft presents. I did not realize such a magnificent job could be done in such a short time. I don't believe the people appreciate what has been accomplished. Our visit was a remarkable demonstration of the cooperative policy of United Aircraft and that is also apparent in the United Aircraft contract to the government. United Aircraft has a great organization."

ALCOA ALUMINUM



Major Al Williams, alias "Tattered Wing-Tip," Major Clark Archer's frequent Gulf Stream fishing partner.



GULF
AVIATION
PRODUCTS



GULF
AVIATION
PRODUCTS

A 4145148, September, 1988



MEN and MACHINES

Alvin Boyler Working On the Turbine

AMERICA'S "Men and Machines" are definitely meeting the tremendous demands that have been so suddenly placed upon them. Fleetwings' workers, many of whom are skilled in the operation of special machines designed by Fleetwings' engineers, are loyally contributing to our ever increasing National strength in the production of Stainless Steel and Aluminum Alloy Ford and Mobile Barrels for the aviation industry.

In addition, Fleetwings' greatly enlarged facilities are now geared to meet on a mass production basis, the exacting standards of precision specifications for Stainless Steel and Aluminum Alloy Ford and Pistons, as well as Hydraulic Valve Equipment.



DESIGN ENGINEERING FABRICATION

FLEETWINGS

BRISTOL, PENNA.

will still be in progress. A little over a month ago, work was begun on still another plant addition which is destined to increase Pratt & Whitney's monthly output to 1,000-1,100 hp. With such an endowment and well earned record as was Pratt & Whitney at least as much reason for the plants to come and contribute their again on their valuable contribution to aviation in the past.

Recent Awards

Heavy Department

Planner International, Seattle, W. A. 114,117 for aircraft components.
Bremner, Albany, N. Y. 114,118 for aircraft.
The Electric Auto-Lite Co., Inc. 114,119 for aircraft.
Bremner, Albany, N. Y. 114,120 for aircraft.
Bremner, Albany, N. Y. 114,121 for aircraft.
Bremner, Albany, N. Y. 114,122 for aircraft.
Bremner, Albany, N. Y. 114,123 for aircraft.
Bremner, Albany, N. Y. 114,124 for aircraft.
Bremner, Albany, N. Y. 114,125 for aircraft.

War Department

The Electric Auto-Lite Co., Inc. 114,119 for aircraft.
Bremner, Albany, N. Y. 114,120 for aircraft.
Bremner, Albany, N. Y. 114,121 for aircraft.
Bremner, Albany, N. Y. 114,122 for aircraft.
Bremner, Albany, N. Y. 114,123 for aircraft.
Bremner, Albany, N. Y. 114,124 for aircraft.
Bremner, Albany, N. Y. 114,125 for aircraft.

Bremner, Albany, N. Y. 114,126 for aircraft.
Bremner, Albany, N. Y. 114,127 for aircraft.
Bremner, Albany, N. Y. 114,128 for aircraft.
Bremner, Albany, N. Y. 114,129 for aircraft.
Bremner, Albany, N. Y. 114,130 for aircraft.
Bremner, Albany, N. Y. 114,131 for aircraft.
Bremner, Albany, N. Y. 114,132 for aircraft.

Bremner, Albany, N. Y. 114,133 for aircraft.
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Bremner, Albany, N. Y. 114,135 for aircraft.
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Bremner, Albany, N. Y. 114,139 for aircraft.

Bremner, Albany, N. Y. 114,140 for aircraft.
Bremner, Albany, N. Y. 114,141 for aircraft.
Bremner, Albany, N. Y. 114,142 for aircraft.
Bremner, Albany, N. Y. 114,143 for aircraft.
Bremner, Albany, N. Y. 114,144 for aircraft.
Bremner, Albany, N. Y. 114,145 for aircraft.

Steam Airplane?

Washington (AP Wire) (B-24) Returned attempt to return the military in a steam engine for use in a shipboard bomber. New ship is said to be not an alternative to having assembly heavy fire power, increasing bank capacity and fine performance. Engines is a 7,000 hp. Wright double-row Cyclone with turbine cylinder.



British gunner working in a mill with operation of a hydraulically operated gun turret at U.S. gunnery and bombing school.

to 1,000 hp. Langley's first airplane was steam-driven, and the idea has been renewed ever since. Engineers are reported using steam now.

Langley's attempt to launch the Army was made about six years ago by LaRue, inventor of the high-pressure steam boiler used by Japs and Germans. He had a central boiler in the fuselage with two 100-hp turbines in the wings developing 1,000 hp each, condenser, with 21 in. of vacuum, was in



Article's drawing of the new Curtiss XSR-1 dive bomber built in Buffalo for the Navy for use as a shipboard bomber. New ship is said to be not an alternative to having assembly heavy fire power, increasing bank capacity and fine performance. Engines is a 7,000 hp. Wright double-row Cyclone with turbine cylinder.

Ward the propeller. Air Corps was afraid of the midshipman system and turned down the idea. The Ford landers made several flights in a steam-powered plane in California a number of years ago.

X-Ray Testing Machine

Installation of a new, fully automatic X-ray machine that will photograph 2,000 average parts per day has been completed at the Triplett & Barton Machine Co. in the Lockheed factory, Burbank, Calif. Representing more than four years of development work, the machine represents a complete departure from previous equipment. All of the high-voltage X-ray equipment is housed in a cabinet 10 ft high and 4 ft wide. It occupies the cabinet is a conveyor table that works in shuttles from side to side. The cabinet and table are fixed with 1,000 lb. of lead to shield the operator from the X-rays, allowing him to work alongside the cabinet while photographing in its presence.

The portion of the cabinet



TRIPLETT & BARTON High speed automatic production X-ray machine now in operation at Lockheed Aircraft Corporation, Burbank.

housing the X-ray tube and transformer works on an automatically controlled electric lift that raises it above the table on which the parts are placed. When the photographic exposure is turned on the cabinet is lowered to place and hold there until the picture is made.

Helium for Defense

The government's helium plant at Amarillo, Tex., has completed production of 200,000,000 cu ft of gas, the Interior Department announces. Helium will be used in new lighter-than-air equipment to be built for Army and Navy and Secretary Harold L. Ickes, of Interior, says he is ready to meet any defense demand. The Amarillo plant has produced 100,000,000 cu ft in the course of its operation, but operated at full capacity, it could turn out twice that much. The cost is just under the per cu ft. The firm is used for many other purposes than floating gas bags. The United States has a complete monopoly. Helium either is in Washington or Germany where the country has been discovered there as "heaven."

From the days of the "Pusher" Curtiss and Goodrich Have Worked Together



Aggressive, high-speed units built by Curtiss are today in the forefront of American defense. As with many of their products, Goodrich Airplane Silvertowns give these planes extra protection when take-offs and landings occur over "bumpy" territory.



When Glenn H. Curtiss won the International Cup Race at Rheims, France, in 1909, his "pusher" was equipped with Goodrich tires.

It was the beginning of a long association between Goodrich and the organizations that later bore the Curtiss name. As aviation took shape and grew, Curtiss development continued to have far-reaching effects upon aviation's progress. Together Curtiss planes and Goodrich Avianium Products became favorites of many of the world's most important fliers.

And today . . . 51 years later . . . Curtiss planes of many sizes and types come from production lines where many Goodrich Avianium Products are built into them.

Just as the expanding needs of aviation have increased the size and type of planes, these needs have increased the range of Goodrich Avianium Products. Where once there were only Goodrich Airplane Tires, there are now Goodrich DEICERS.

Goodrich E.T.T. Deicers and over 40 other Goodrich rubber products to meet the demands of aviation. Write The E. F. Goodrich Co., Avianium Div., Akron, O., for information.

*Goodrich Exports: Taire Sales are manufactured under license and sold by: Hertz Industries, Inc., Jackson, Mich., and South American Corp., South West, Ind.



IT HAS TO FLY
and it pays to take off
and land on Goodrich
Airplane Silvertowns
across the roughest sta-
blest there ever built



Goodrich Airplane Silvertowns

THE SAFEST AIRPLANE TIRES EVER BUILT

Over 40 Safety Products for Airplanes—Including Tires—Tire Chains—Aluminum Shoes—DEICERS—Skidding—Fueling Hose—Grounds—Black Aircraft Cord—A Complete Line of Rubber accessories accessories.

NEW Striking Power of the FLEET



CURTISS XSB2C-1 DIVE-BOMBER

The Curtiss XSB2C-1 Dive Bomber, developed jointly by the United States Navy and the Curtiss Aeroplane Division, Curtiss-Wright Corporation, offers performance and versatility never before achieved in aircraft of its type. In addition to movement for its own defense, this new weapon is capable of carrying increased bomb loads and heavy fire power—at high speed over a great distance—for making its attack with deadly striking power.

The XSB2C-1 is equipped with a Wright Double-Wright Cyclone 16-cylinder engine. Now nearing completion, it will soon be in the hands of the Naval Test Squad and will offer new efficiency power to the Navy when armed with carrier weapons of the U. S. Fleet.

CURTIS AEROPLANE DIVISION
CURTISS-WRIGHT CORPORATION
Buffalo New York
"The Pioneers of Aviation"

Curtiss

PRECISION-BUILT ARMY AND NAVY AIRCRAFT

1

WYMAN-GORDON

WORCESTER, MASS.
HARVEY, ILL.
DETROIT, MICH.

Guaranteed Forgings



Grain Flow Control

at a loss in the period cited in the previous twelve months right at the current reported deficit.

Glenn K. Harris Co. is reported planning to spend \$104,000,000 in more than double present manufacturing floor space.

Republic Airlines has plans to triple its January sales.

Boeing Airlines had the largest second quarter sales, profits and earnings in the company's history. New orders exceeded shipments and unit volume increased to approximately 100,000. Number sales not looking as yet reflect the new national defense program.

While the investment industry may still continue campaigns on "in the red," they are really only in the spotlight, according to Robert T. Green, president of Lockheed Aircraft. In an annual open letter to investors and investment dealers, Mr. Green frankly expressed his opinion over the future of the industry because of its intimate link with the defense program, the growing demand for commercial planes and markets that demands of ready transfer there will make after the war. Answering a special department to answer financial inquiries of all kinds in the Lockheed company, Mr. Green asserts that he can furnish information both enlightening and reassuring to any who have reservations about the outlook for the aircraft manufacturer.

Consolidated Aircraft has just recently completed its \$20,000,000 building program and probably will deliver planes valued somewhere between \$10,000,000 and \$15,000,000 in the final six months of 1946, at a profit \$100,000 in the first half. The new facilities should enable an output of more than \$10,000,000 monthly. Yet there is a possibility of some further plant expansion in the coming months.

United Air Lines intends to appeal the recent CAA decision forcing air mail rates over its system. While the line receives \$24,000 in loss per day, the new rates are expected to reduce United's present annual net by around \$100,000.

North American Airlines also plans to erect a stable plant at a new location, according to President J. H. Knudsen. Additions new order correspondence will increase present facilities to around 1,000,000 sq. ft. this year. The company's 1,000 employees are working in two shifts in a new four-day-a-week plan.

Revere Airlines was denied a certificate of C and N for the termination of aviation service from the Philadelphia Municipal Airport in the roof of the city just office. However, the board held that the issuance of a temporary certificate would be justified.

Pan American announced its order for five 341 Douglas transports, also announced its intention to file for a month sale of C and N for the Chicago-Pittsburgh.

Northeast Airlines establishes a new business route with 12-100 revenue passengers in July.

United Airlines will appeal CAA's mail rate decision, and ask recommendation of the Airline's order force air mail rate over for review.

TWA, pending the action of the CAA on its application to purchase and operate Macquarie, has been given an emergency order to permit temporary operation of Macquarie. The service began on Aug. 10.

American Airlines to help Chase J. E. is now here, told him he could pay for his ticket at any Wartara Union Office. Mr. Li entered telephone booth called "W. U." and, "My name is J. E. Li. Here's the price of my ticket to Boston," and started ringing rings into the dial.

Trans-Canada carried nearly four times as many passengers during the first six months of this year as in the corresponding period of 1945.

Canadian Airlines will receive its second order from the Army and Navy Department and New York City. CAA approved its application to operate sales agency as a scheduled stop. On Aug. 11 started New York Niagara Falls service.

Midcontinent Airlines granted by CAA a new T-400 route between St. Paul, Minn. and Kansas City, Mo.

Boac Airways continued, during July, 50.15 percent increase over July 1945.

British Overseas Airways announced a reduction of fare between Sydney, New South Wales and Auckland, New Zealand.

Alm's For Sea service is being continued, and is running from Baltimore to Java.

Island Express Agency advises that air express shipments for 10 day period 38 percent over May 1945.

AVIATION—December 1946

BW PRINT



BRUNING MERCURY "75" CONTINUOUS BW PRINTER



Representing an entirely new advance in printing, the Bruning printer is designed for use with the Bruning Model 211 Developer, for high speed production. The "75" printer has a greater speed—runs at 25 feet per minute. Good BW Prints from one set coming to three can be obtained at a speed of 20 to 25 feet per minute. The Bruning "75" Printer can also print on heavy weight paper—continuous operation in less than one third of what is used by any other machine of same speed and capacity.

SPEED THE WORK WITH PRINTS THAT

Fly



Prints faster—every minute clipped off your production time means greater speed—greater profits—in meeting today's demand.

You can speed your production all along the line by reproducing your tracings with Bruning Black and White Prints—the Black line prints are produced with such amazing perfection, they almost seem to fly.

Why are Black and White Prints faster than Blue Prints? Because they are repeated and developed in a matter of seconds. Because the BW Print can obtain possible the quantity production of prints cut to the size of your tracings through the use of BW pre-cut sheets. Because BW Prints

require no time-consuming waiting or drying.

Two simple pieces of equipment—a BW Printer and Developer—are all you need to produce these quick BW Prints. The cost of making BW Prints is often LESS than that of blue prints—as proved by actual experience.

The Bruning Black and White Prints to secure a fast, new flow of print production—to save time and money. A new, free booklet, "New Light on Prints," tells the whole story of the BW Process—gives valuable information about time-saving prints. Send today for your copy.

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City _____ State _____

..IN Style

*Luxurious and Comfortable as Your Home—
Faster Than Any Plane in Its Price Class*

- Don't "clump out" to get speed. The new Waco Model "T" Aristocrat gives you every conceivable comfort and cruising speeds as high as 200 miles per hour. That is a combination heretofore unheard of in planes of this price class.

Finish like a fine automobile—deep spring cushions—ample room for five passengers—

biphasic construction for more comfortable flying and easier landing—"cushioned power" engine mounting.

Waco, the oldest manufacturer of commercial planes, sets a new standard.

Write for the name of your dealer and see the luxurious, new Aristocrat.

● 2010年10月1日起，凡在中华人民共和国境内销售货物或者提供加工、修理修配劳务以及进口货物的单位和个人，均应按照《中华人民共和国增值税暂行条例》及实施细则缴纳增值税。

AVAILABLE WITH JACOBI LITERARY
PART 4: POETRY AND PROSE EXCISES

WACO AIRCRAFT COMPANY
TROY, OHIO



1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 26

|of high winged monoplanes|5000 for doctor and hospital

The Lark Men Pioneer Air Mail Club announced last evening will soon publish its list of members. Edward Nelson, acting secretary, of 5120 North

I will soon announce the DLA 120 Trainer for the Civil Pilot Training Program to be produced later this fall.

Some And, Concord, Upper Sonoran who worked for the Air Mail Division of the Post Office between 1929 and 1937 to send in their names. The group is strictly non-commercial and will have no dues. Several hundred former air mail pilots, mechanics and other post office employees have already joined.

Schro winners in the contest which has been staged by Franklin Associated Motors for Aeromarine and Cub dealers were announced last month. Grand prize winners in the Aeromarine division were: first place, Aero Ways of Cleveland, Ohio; and second place, Rothe Air Service

Carl Brers, Lessor's dealer in the New York City area, finds he is selling as many computers as handplanes. In ten weeks he sold eighteen Lessor's, none of which were equipped for water flying. A dozen of them

received the amount in behalf of Jess Waga and was the \$25 salesman's prize. Ray Beck received \$150 for his company with Frank L. Gushing receiving a like amount as leading salesmen.

known at the Floyd Bennett Field Spooks, who made week-end trips last summer in their Luscombe land planes, now are using seaplanes and visit shore resorts each week.

In the Piper Cub division, first prize went to Des Moines Flying Service, Des Moines, Iowa, represented by Howard Gregory and E. W. Cook. Second place went to Lou Finkle Flying Ser-

New Air Mail Pickup. All American Aviation, Inc., has inaugurated service over three permanent named pickup routes centering out of Pittsburgh to Philadelphia; Hammonbury; Jamestown, N. Y., and Huntington, W. Va.

In Kansas, Kansas, Texas, and other states, the state of Kansas has a long history of being a leading producer of leather goods. The state's leather industry is a major part of its economy, and it has a long history of producing high-quality leather goods. The state's leather industry is a major part of its economy, and it has a long history of producing high-quality leather goods.

tributor for Northern California as well, and his name

Cineano—According to officials of the Hawker Aircraft Corp. of Chicago, their plans for distribution in the Eastern States are now complete.

in new twist has paid pilfers the lowest in history, they claim. For \$19 a year you get a policy that pays \$1,000 death benefit for aviation accidents, up to

\$500 for doctor and hospital bills, medical reimbursement of up to \$1000, and coverage for all types of accident accidents including falling out. Student pilot rate is six months for \$300.

rated Arystan Underwriters are Station 305, as held more by William W. Walter is firm it about the country. The firm represents the arystan depositories of 35 insurance companies, and the ship is expected to fly over 50,000 miles a year.

Coast Air Terminal. The Northern California appointment came as a result of the sales raised in Southern California, where the entire pair's quota of planes was sold in the first few months of operations.

The Ace Aviation Flying Service, which has been located at the Municipal Airport for more than ten years, is very busy these days with CAA students. With the opening of several of his instructors, Jacobson has been able to take on a lion's share of the Kansas City CAA business. He now has 38 private students on the Kansas side of the river, 25 in Missouri.

In Northern California include the Simons Flying Co., division of Duck Air Services, of ASA Airways, and the Duck operation is Red Bluff and Redding. Southern California section are established at Union Air Terminal, Los Angeles Metropolitan Airport, Clower Field, Los Angeles Municipal Airport, Torrance Airport at San Bernardino, and Imperial.



LEE HIFSON, left, instructor at the Harvard-Radcliffe Camp, checks a map with student Charles Goin. This was one of the many colleges that carried on C.A.B. Night instruction throughout the summer.

THE BOYS AT THE HARVARD AVIATION CAMP were all still flying when this was taken. Twenty-plus students carried on flight training under C.A.B. at this camp at Falmouth, Mass., across St. William Baker was in charge of the ground school.

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Fast Around the World — Fast in All Defenses



DOUGLAS

DOUGLAS AIRCRAFT CO., INC., SANTA MONICA, CALIF.

Airline Progress

(Continued from page 38)

Flying was different, too. There was no space for passengers, and the pilot rode in an open cockpit instead of a stream-lined cabin. We wore a lot of the war time leathers that started many of today's famous pilots in their hard-earning careers. But it was the American-built Duffelbender that carried the bulk of the early air mail. The Army had a vast surplus of these machines at the end of the war, and they were passed on to the Post Office Department for mail planes.

Planes that were satisfactory to the Army were not satisfactory to the air mail pilots. The Duffels were just rough enough a series of changes that the original designer would not have recognized some of the modified models.

Loading gear was moved forward, gear wheels were shifted about and the tail nacelle was altered to hold the mail. Several kinds of wings were used. A stronger wing was put in the fuselage.

"Every pilot in those days had his own airplane," said R. S. Johnson, Eastern Division operations mgr., in a recent comment recently. "At Maywood Field, Chicago, where we refit the Duffels, we had to modify each plane to suit the pilot. We built the suit to fit him. Each suit had its own slots along the slope of the windshield. And they wanted their glass windows, too. They had a rough time flying in those days, and we gave them what they wanted."

Engines were different, too. The DH was powered with a 400 hp Liberty engine. Spark plugs were changed after every trip.

"We changed pilots by the barrel," said a United Airlines man who had been a mechanic at Maywood. "They were Army surplus material and we just changed them as fast as they were used. Double-line leads were also changed after each trip. One chief air mechanic, though, was the worst. We had constant trouble with these—and so did the pilots. In fact, the pilots tried to strangle their double leads so that they would be sure a welding stick. The pilots got to know where all the welding sticks were along their routes."

"When we first began servicing mail planes," he continued, "we gave the Liberator a complete overhaul every 30 hours. Then we put the overhaul period up to 100 hours when a wing was out of the line. Occasionally a pilot got hold of an engine that he didn't want to give up after 100 hours, but most of the engines were needed on overhaul after 100 hours."

Today there is 600 hours between overhauls."

At Unkley's main overhaul base in Chicago a group of maintenance men were looking over early pictures and discussing the old days.

"We used to get up at three in the morning in the winter," said one. "We had to, if the pilots were to leave on time. The hangars were practically open barns and were cold as an ice house. The only way we could get the Liberator started was to load water in the small hangar stove. We had to heat the oil, too. Then we'd pour in the water and start, and several of us would stand a shiver by holding hands and would puff the propeller through. We had to work fast as the water would freeze. Half the time we couldn't get the engine started and would have to draw the water and oil and start over again."

But Unkley had the real problem. There was little or no reliable weather information. There were no two-way radios at that time. Companies were not dependable. An airplane could fly only 500 or 400 miles between overhaul. Right had to fly under the weather, and we wouldn't trip the weather pretty much on the nose. On national trips they seldom lasted over 4,000 ft.

Listen to Postmaster Earl Hunt of Chicago, who has been in charge of that branch of the government work there since the outbreak air mail days. "Those days were top-notchers. How they got through some of the storms we learn on the ground news lines. One winter day I was out at the field and it was snowing so hard we couldn't see 100 ft. It was Jack Knight's schedule, going out. I said, 'Jack, you're not going out in this storm.' And he said, 'Sure I'm going out.' He climbed into his biplane, fastened the seat, the boys waved us his ship and off he went. He disappeared in the snow before he got off the ground. We sent him signals, overhead, but this minute. Then he was gone. I felt pretty bad about it, because I was sort of responsible for the boys. But later on we got a telegram from North Platte saying he'd arrived all."

"The pilots used to fly by watching the swanlike signals of the U. P. railroad. When the weather was a low they used to fly right along above the rails and I guess a lot of them just barely dipped the tail from elevators along the tracks. They had so many levelled hangars every one in the country that the U. P. gave out all switch house keys. They could walk along the tracks and they came to a switchhouse and they could walk inside a train case. The U. P. gave orders for all of its trains to stop to pick them up."

Once Frank Yeager had a forced landing near Medicine Bow, not far west of Laramie. His wind so he needed a whole new engine. So our mechanics loaded a fresh Liberty on the Overland Limited—the crack train on the line—and the Chicago manager ordered the train to make a special stop at Medicine Bow and even put a rescue crew on at bed at 2 a.m. to unload it. So Frank got going again that same day. But a lot of the boys weren't that lucky. Several hangars in some sections was a tough business."

When the aircraft schedule line went through from coast to coast the mail was flown only at the daytime. At night it was put on trains, carried until the next morning, and shifted to planes again. Although flying across the Appalachians and the Rocky day after day, and keeping schedules along the entire route was an heroic undertaking, and the outstanding thing of its kind then being done anywhere in the world, it did not get a great deal of attention from Congress or the public. The Post Office Department, as well as the pilots, realized that before any real appreciation could be made by Congress the mail would have to be flown by night and day continuously from New York to San Francisco.

So plans were made for what was later to be called the great night flight—or perhaps the great Knight flight is a more appropriate title. Early as Feb. 22, 1931, mail was loaded into a ship at San Francisco and flown toward Reno, then to Salt Lake, Cheyenne and on to North Platte, Neb. There it was picked up by Jack Knight who was to fly to Omaha. But when he reached Omaha, there was no pilot to meet him on to Chicago. Jack had already flown two trips that day and he was tired from pushing his plane ahead in the m. It was already dark, and he was not familiar with the route to Chicago. He had been in a crash-landing a few days earlier and his nose was broken, which added greatly to the discomfort of flying through the cold February weather. Another pilot might have said, "Enough is enough!" and the American flight on which all of our employees were counting might have ended right there. But Knight ordered his ship refueled and off he flew into Chicago's darkness.

The Post Office had wired ahead and requested that business be left at airports and other critical spots along the route. But there began to fall, and hands, one only a little light at best. He picked his way along the route, relying more on his own experience than on his remote compass or the starlight map on which he peered occasionally. Over Iowa City the flight almost ended in catastrophe. One of the gas, not more



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Already operating the largest commercial fleet of aircraft in the world, American Airlines is now taking delivery of additional Douglas aircraft which give it exclusively Wright Cyclone-powered fleet a total of over a quarter million horsepower. Every hour of the day and night, at least 22 Cyclone-powered Douglas flagships are in the air flying American's 71,000 miles of scheduled daily routes.

American has logged with safety over 780,000,000 passenger miles in the last 4 years alone behind Wright Cyclones, and will this year carry nearly a million passengers, considered a remarkable showing for the entire industry a few years ago. These figures are suggestive evidence of the part played by Wright Aircraft Engines in the advancement of air commerce.

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WRIGHT Aircraft ENGINES

where he was, or where the field was situated, he considered a forced landing. Suddenly one of the darkness below a black light flared. Jack curled close and made out an air field. The plane had been hit by the fall's night darkness, which helped Jack go up and continue on his way. How after hour he pushed air, keeping himself awake by pushing himself and clapping his feet. At dawn he reached Chicago where the mail was turned over to a local pilot and mailed on in several stages to New York. The mail reached the East Coast 33 hours and 21 minutes after it had left San Francisco. This was a new high in airmail speed, as the last previous time had been 78 hours and 44 minutes.

This flight was not just a stunt. It brought concrete results in that Congress appropriated money for lighted airports, although it was 1924 before regular day and night schedules were flown across the country.

By 1926 the Post Office Department concluded that the time had come to turn the air mail business over to private contractors. *Vernor Air Lines* was the first private company to carry the mail. Pacific Air Transport began flying from Seattle to Los Angeles in 1928. In 1929 Boeing Air Transport started the route from San Francisco to Chicago, and that year National Air Transport began flying the mail from Chicago to New York. Later all four of these companies were combined to form United Air Lines.

Gradually other planes besides the De Havilland came into use. By 1929 National Air Transport was using a dozen kinds of airplanes, including DH-3, MacCarty, two types of Cessna, Curtiss Rogoite, Travelair, Douglas mail planes, Ford Tri-motors, Stearns, Percival, Shortages, Falcons, and two kinds of Harvards.

Passengers began to be carried when the Boeing 40's were introduced in 1927. It cost \$400 and took about 32

hours to cross the country, and refueling stops were made at some desirable places. Passenger comfort was given little consideration. In 1927 Boeing Air Transport put its large Boeing 40's into service. These were three-level ships that could carry twelve passengers which later were adapted to carry fourteen. The following year NAT put 700's in service, and multi-motored airplanes were available from coast to coast. In 1931 United Air Lines was formed and gradually the names of the four predecessor companies dropped out of use.

The year 1933 marked a milestone in air transportation when United put the revolutionary Boeing 379's into service. They immediately outmoded all passenger airplanes then in service. Equipped with two 550 hp. Wasp engines, the Boeing carried ten passengers and a crew of three at speeds up to nearly 3 miles a min. By 1937 passenger traffic over the Main Line had grown to such proportions that United needed larger airplanes. Douglas DC-3's were added to the 247's in service. Shoppers as well as more luxurious day planes were added to the public. The next step will be the four-engine Douglas DC-4's next year.

Every phase of air travel has made progress over the old days. The longer cruising ranges of today's ships bring added safety. If an airport is closed down, the pilot has ample provision to fly elsewhere. With even an aircraft as big as the Boeing 247, the pilot has enough range to fly only from Chicago to San Diego. Today he can fly from Chicago to Salt Lake and land with plenty of gas in his tanks. The story of United's engineers who developed two-way radio is told elsewhere. The safety features of ships are appreciated only by those who fly in the old passenger ships, at which a pilot was forced to fly close to the ground so he could see familiar landmarks. Today a pilot can fly far

above unpleasant weather. Pilots now have an improved flight technique. Formerly one pilot flew high, another low, one made sharp turns, another kept straight.

Now all fly alike in the one way that has been found to be best. The passenger airlines today are a far cry from the old, black lumber ships where passengers used to wait for planes. Continuous service is improving each year. Tariff reductions mean more frequent routings and lower fares, as well as all-expense tours.

Air trips today, now held by 10,000 persons, have brought reduced fares for persons and firms doing much business. Food service is one of the great strides forward. In the old days a passenger had to bring his own sandwiches. Today he is served a hot, five-course meal at no additional cost over the price of his ticket. Standard service, introduced first in this country by Boeing Air Transport in 1930, brought new comfort to passengers.

Air travel is moving so fast that even conservative prophets are out of date in a short time. With supercharged, high-speed DC-4's soon coming into the picture, travel by air will be faster and more comfortable. Fares, as the future will undoubtedly be lower. There will be more routes with two stops, such as United now has from San Francisco to Los Angeles, with less being charged for the slower service.

There will be more fast airlines, connecting groups of airports in a large metropolitan area with the main terminal. In the New York area, for example, there are half a dozen fields within 30 miles of La Guardia which could be tied together by a link line. There will also be more immediate services from towns, without airports to towns where airlines stop. At present there are only 250 stops on the airlines. In the future many others will have feeder line service. Cargo ships will be used on the main lines and ships routed to the two-motored vessels will carry much more air cargo than is the case today. Charter service is very much on its infancy today. United alone had more charter service in the first four months of this year than in all of 1936.

Air travel is the logical, modern way to travel. Each month airline business is from 30 to 70 percent better than in the same month of the preceding year. The problem of the airlines today is not so much how to get new business as to accommodate what they have. Air travel has gone through the trying Twenties, the troublesome Thirties and has now reached the flying Forties. From the beginning of commercial air service in 1926, so many forms of travel has ever made so much progress in twenty brief years.



Some DeHavilland mail planes lined up at Omaha in 1931.

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Airline Research

(Continued from page 31)

1934 to the Chicago Airport. The men making up the staff of the laboratory are either experienced men in the field of radio communication or men who already know airplanes where they have studied electrical engineering.

The laboratory has three objectives. First of all, it takes over work of commercial manufacturers. This takes the form of developing special radio equipment when the manufacturer either lacks the necessary research facilities or does not feel the radio scientist's large expenditures in research. Second, the laboratory tries to place itself in a position to deal with manufacturers and to advise the airline's purchasing personnel in acquiring new equipment. The third aim of the department is to assist in solving service problems. There is no better place to investigate these problems than in the communications laboratory. The engineers, through their long experience in research, have a full knowledge of the problems that present themselves in radio communications and are constantly working toward what might be called an ideal system.

The facilities of the lab at present occupy about 15,000 sq. ft. in the United Nations at Chicago Airport. One section of the lab contains all the testing equipment as well as a workshop for building newly designed equipment. There is also a model shop for the construction of new designs previous to testing, and a start-working shop. Most line problems in the world are

Organization of Research



related to the lab line in research. Men working out on the long contribute a great deal when they find "bugs" in the communication system or in the equipment. These problems are sent either to Chattanooga or Savannah for maintenance consideration. Together with these are the ideas that come from the communications laboratory personnel. The problems that repeat further research are then identified into a program by Data Scientists. The first step is to make a preliminary report, including all of his own ideas on the subject, plus reference to previous work that has been done in the lab or in other research labs. When the report has been turned over to one of the staff for study an entry is made upon a board so that an answer check can be kept on the progress at all times. The engineer to whom the work has been assigned is then left entered on his own in complete the project. Research and design are done by him and the model is constructed and tested. The laboratory test program (a very thorough one) requires that first the equipment work efficiently under normal conditions. It then

tries the results on the reflection high altitude chamber (if altitude is apt to affect the operation) the wind chamber, and finally the drop test. After this it is run in service operation. An engineer usually accompanies the equipment on what is called a service test. When the equipment has successfully completed the program, and the company has decided to adopt it, specifications and recommendations are then sent to the purchasing department.

Of course, all during the complete research test and service test programs reports are turned over to Scientists at regular intervals, who keep in constant touch with all of the work in the lab. Once each month he makes up a progress report showing the exact status of each project and turns this over to the officials of the company.

One of the latest developments of this department was the two-way radio communication. No system need be given explaining how important this has been to successful airline operation. A few years ago, after a lengthy period of research, United developed the static electric cancelling use of the major contributions to developing ground communication. As a result, static encountered during certain types of bad weather has been practically eliminated. All United ships carry two of these devices. Incidentally, the lab for the research work on this was \$30,000.

In another line of radio communication the laboratory has done a great deal on instrument landing. At a number of the world's airports, some located at several airports throughout the country with standard services installed on United planes. Although at present the government has adopted another system of instrument landing, there is no doubt but what United's work has certainly been a great contribution to this type of navigation.

Research in operation as a result of research work is obtaining enormous for but a single piece of equipment. As an example, a redeveloped instrument particularly had cost \$10,000 per unit. Power saving on the new one was not 90 percent and the price

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proved performance Pesco pumps now offer that too, in terms of the previous Chicago Rawhide accomplishments. It is simply added evidence of Chicago Rawhide's superior technique in processing Synthetic Rubber.

If you need a plastic part, success is not, here, in light, age, or combination, call on Chicago Rawhide. An inquiry will place at your disposal a man experienced in how Synthetic Rubber can be most successfully applied. Write today.



THE HEART OF THE PESCO PUMP
is the Synthetic Rubber diaphragm. It automatically adjusts itself to compensate for changing demands in atmospheric pressure and engine inlet flow so that the fuel pressure stays uniform in operation. Fuel pump failure is impossible.

NEW PESCO AIRCRAFT FUEL PUMP
for which Chicago Rawhide developed a new Synthetic Rubber diaphragm which lengthens its life more than 4 times!

PESCO-EQUIPPED AIRPLANES

Pesco Fuel Pumps have become "standard" in aviation for their outstanding performance under all conditions of service. Units:

BARKLEY MOON	EUROPEAN	NORTHROP
BOEING	DOUGLASS	SPRUELL
WALL	HERCULES	SPRUELL
BRALING	DOUGLASS	SPRUELL
BOEING	BOEING	SPRUELL
SPRUELL	BOEING	SPRUELL
CHRYSLER	BOEING	SPRUELL
CHRYSLER	BOEING	SPRUELL
CHRYSLER	BOEING	SPRUELL
CHRYSLER	BOEING	SPRUELL

SYNTHETIC RUBBER DIVISION

CHICAGO RAWHIDE MFG. CO.

Established 1878

1305 ELSTON AVENUE • CHICAGO, ILLINOIS

NEW YORK CLEVELAND DETROIT LOS ANGELES

BOSTON PITTSBURGH PHILADELPHIA ST. LOUIS



Colonel B. B. Tullis, director of Medical Research, gives one of his staff a look at his latest communication. There are 10 distinct steps and 41 different tests given in this type of secure radio efficiency.



THE MODEL 18 all-metal BEECHCRAFT powered with two 450 H.P. engines has been selected in various versions by the United States Government and foreign Governments. Among the uses to which these high-performance airplanes will be devoted are Mapping Photography, Personnel Transport, Ambulance Service, Observation, and Military Training.

The selection of the Model 18 BEECHCRAFT for these different uses was determined by one or more of the following abilities that it possesses:

1. It can fly high. (It cruises easily at 25,000 feet altitude.)
2. It is fast. (It cruises at 260 m.p.h. on 625/55 power.)
3. It has low speed stability. (Power-on stall occurs at less than 55 m.p.h.)
4. It can utilize small fields. (Take-off run is 300-400 feet.)
5. It has excellent payload with large cruising range.
6. It is adaptable to dense and complex fields.

The combination of these abilities in one airplane is unusual. They add up to make the Model 18 BEECHCRAFT a superlative vehicle of personal transportation.

Several are under construction and are available for early delivery. After these are purchased, future deliveries will be subject to U.S. Government priorities and considerable delivery delays probably will be unavoidable. Responsible inquiries are invited.

BEECH AIRCRAFT CORPORATION

4411 EAST CENTRAL • WICHITA, KANSAS, U.S.A.

KOLLSMAN



Chooses **NORMA-HOFFMANN PRECISION BEARINGS**
for ITS PRECISION INSTRUMENTS

Kollsman Instrument Division of Sargent D. Company (Elmhurst, N. Y.) says, "KOLLSMAN FOR PRECISION is not just a phrase. It is both the ideal and the achievement of KOLLSMAN INSTRUMENTS' ***** In performance, KOLLSMAN PRECISION INSTRUMENTS function to unsurpassed standards of accuracy."

As measuring up to their own standards of precision, quality and performance, it is natural that Kollsman engineers should turn to NORMA-HOFFMANN PRECISION BEARINGS for the Kollsman Constifugal Tachometer, for the Magnetic Tachometer, and for the generator of the Electric Tachometer.

American instrument makers—both those supplying the aviation industry, and those serving the industrial and scientific fields—have been using NORMA-HOFFMANN PRECISION BEARINGS for years. They recognize that NORMA-HOFFMANN PRECISION stands for those characteristics which concerned them for the exacting duties of precision instruments.

Similarly, builders of aircraft and of aircraft accessories and equipment, avail themselves of the dependability and thrust-free performance of NORMA-HOFFMANN PRECISION BEARINGS—"where the bearings must not fail." For NORMA-HOFFMANN have been PRECISION BEARINGS from the earliest days of the bearing industry, and many of today's standard aircraft bearings were developed and pioneered by NORMA-HOFFMANN.

Write for the Catalog. Let our engineers work with you.

"NORMA-HOFFMANN"
PRECISION BALL BEARINGS

NORMA-HOFFMANN BEARINGS CORP., STAMFORD, CONN. U.S.A.



brought down \$400, as well as resulting in a salary reduction. Nevertheless, the money saved in this one alone for that year amounted to almost \$100,000.

Engineers Research

Ray Kelly, in charge of the engineering research department, has four project engineers under him who handle the passenger members, power plant accessories and theoretical design. Each one of these project engineers in turn takes over all problems that are presented about his department and frequently two of them work together when a project is of mutual interest.

Problems come to the department in much the same manner as they do in the manufacturing section. They appear as preliminary reports it made out. First, the project engineer is assigned, whose job it is to start investigating the problem work that has been done. When he has decided upon the design of the new equipment, the work is turned over to the engineering department to draw up the plans. Manufacturers are then contacted and then go the specifications to build the equipment. This means the project of testing. If a part is to be eventually be installed on one of the planes, it is first given flight tests either in the flying laboratory or as one of the trim-ups designed for that purpose. After the flight test has been successfully completed, the equipment is installed on one of the regular transports and an engineer assigned to accompany the ship for a period of time, making further examinations as to operation.

All of the data collected during these flights is entered on various forms in



The cells laboratory has designed a control panel for the DC's which admits any type installation.

On an airplane record is kept at all times. These flight reports are then sent back to headquarters at Chicago where they are kept on file with all of the other material on the project. In addition to these, every week a service unit record is made from the shop to which the equipment has been assigned. All irregularities are reported as well as recommendations which are of great help in working out the bugs in the new equipment.

The reason for this research is not that it is to let the equipment not work satisfactorily, or that it is inefficient, but that the engineers believe in better when they have developed. It can still be improved upon. There is no better place for finding just what these improvements can be than in observation.

tion during actual flying conditions. That a service unit is given to all parts of the plane, which points results that are of enormous value in further purchasing of equipment for the company and even in the designing of new ships for the line.

The issue of the passenger comfort department is self-explanatory. Research along these lines is one of the most extensive carried out by the company and results being returns in dollars and cents. After all, there are only a few passengers interested in the details of the operation of the airplane, most of them wanting to get from here to there as quickly and as comfortably as possible. But what they do notice is the food, heat, ventilation, sound-proofing, etc., and these are but a few of the problems tackled by the passenger comfort engineers. The results speak for themselves.

To the power plant section are turned over all problems dealing with the operation of the engine and propeller. New types are always under investigation and the maintenance section record that the surfaces have needed up for the past several months shows some of the accomplishments of this department. Work on engines, landing gear, instruments, etc., falls under the responsibility of the accessory department. Here again is a field largely responsible for the safe operation of the aircraft.

Medical Research

The most important physical variables affecting people while in flights are vibration, noise, variations in temperature and altitude. With this in mind the medical research department works with but one proposition in view—"knowing that is able to work is able to fly." Under the able direction of Colonel Tinkle, a new-and-improved program of investigation and research is in progress to build their firm belief in safe and comfortable air travel.

Started in 1938 when United Air Lines completed the construction of the newest center in its Chicago headquarters building, this department has grown in its scope of activity until now everyone, whether he be a mechanic or charterer of an airplane, is under the constant watch eye of the medical staff. To be more exact, they carry out the dual responsibilities of providing the best possible health service for flight as well as ground personnel and undertake the investigation of passenger comfort also.

Each person employed by United must cooperate with the medical department to make certain that he is in a constant state of good health. A pre-employment examination confirms the fact that employees are healthy at the



The "Operation" class of 40. Present board ship is ground through actual operation of a simulated air bus.



At the table desk, maintenance coordination and other problems are handled by a student relief agent.



Students in the office after lunch meal, and passengers, with all the pilot with the flight plan in hand.



Reading weather reports, the student agent ships their weather data, with problems prior to takeoff flight.



With two-way radio, the student in the plane keeps in contact with the ground station during the flight.



The class watches checking of engine and fuel while the mechanics make the inspection prior to a simulated flight.

You Need the PLUS VALUES in PARKS Leadership Training To Fit Yourself for Success in Commercial Aviation

As one of many young men today who are thinking about and planning for a career in commercial aviation, you realize that your success will require much more than flying and mechanical skill. Flight and mechanics are taught at Parks, to be sure, but these skills, by themselves, are not enough. You require much more if you are to make valuable contributions to the industry or as a transport, help it to develop and continue as a profitable business.

The high standards maintained at Parks, the thoroughness of its complete educational plan, are designed to develop your capability to do original and constructive thinking, to equip you to contribute to the profitable

and successful progress of aviation as an industry.

Parks wants closely with the aviation industry and Parks can and does qualify you to meet their strictest requirements. At Parks your education will go far beyond mere knowledge of flight and mechanics; you will acquire a sound and well-balanced background, increase your ability to think for yourself and acquire practical knowledge of the problems you must meet and solve in order to advance to leadership.

To prepare yourself for leadership in aviation you should first know all the facts about the training program of Parks Air College. Parks offers you a college education, specialized and

practical, in each of the four major branches of commercial aviation—as four courses are: Professional Flight and Executive, Aviation Operations and Executive, Maintenance Engineering and Aeronautical Engineering. Make the coupon today for complete information. The catalog will be sent you free of charge or obligation.

PARKS AIR COLLEGE East St. Louis, Illinois	
Please send me details of four major courses in commercial aviation including:	
Name _____	Age _____
Address _____	
City _____	
State _____	



The high altitude test chamber is used by all of the research departments. It is the only one of its kind owned by an airline. Here a noble (engine) engine is about to be tested.

PARKS AIR COLLEGE East St. Louis, Illinois



BEHIND THESE WALLS LIES TORTURE *and Safety!*



THE SODIUM-COOLED AIRCRAFT VALVE
Pioneered and developed by
Eaton's Wilcox-Rich Division.

THIS is the Engineering Research Laboratory of Eaton's Wilcox-Rich division. It is the largest and most completely equipped laboratory in the world devoted to the study of valves, valve train design, materials and performance.

Behind its walls, inquisitive and persistent

engineers, never willing to "let well enough alone," literally "torture" materials and finished products. Stresses, strains, heat, wear—everything a valve must cope with in actual service is intensified and carefully analyzed.

The result is greater safety, longer service, finer, more trustworthy performance in day-to-day flying, because of greater precision in

manufacture—finer quality in materials—and uniformity in the finished product.

Eaton engineering and research have conclusively proved their value in the development and continued improvement of the Rich Sodium-Cooled Valve and other Eaton Aircraft engine parts during more than twenty years' close association with the aircraft industry.

EATON

EATON MANUFACTURING COMPANY

size they become a member of United's staff. Then to make certain that they continue to be at least as healthy as when they started, periodic examinations are given to every person. The thoroughness of the examination varies according to the type of work that the person is doing. The most difficult is the examination given to the pilots.

New training and graduating the workers are in constant medical examinations of pilots is completed in the new full-time laboratory and clinic. Medical equipment alone cost \$150,000. At least once a year each pilot of the United system is examined by a physician for personal examination to Colonel Traffic and this super overhaul is given in addition to the regular examination taken yearly. Such an examination takes more than two hours to complete and fills out a 12-page work sheet on which there are 94 general and specific points plus sub-points.

The eyes must be taken at on the ear during this exam where, for example, there are 23 distinct steps and 53 different tests given to insure complete efficiency. A pilot can't even read what he puts a record for this reveals what type of vision he is lacking in his system. For instance, an inability of Vitamin A, which the vision and makes for "night blindness." To test this the pilot is observed to view at a special light for three minutes which blanches the "visual purple" from his eyes. This obliteration of visual purple is what happens to automobile drivers at night when they are blinded by glare from the headlights of approaching cars. After the visual purple is blinched, all light except a small amount of very low luminosity are shown. The pilot then sits in the dark and watches for a small dim light to return, and he is required to describe the size at which it is seen. A stop



Inside the flying laboratory units along one side have been removed and a bench mounted for test operation. New radio equipment is put through a flying test for all weather conditions. Results have proven of tremendous value in the design of new study tests and redesigning of old. The cockpit instruments have been left unchanged.

watch is used to determine if he can correctly identify the position of the test object in no more than three seconds. If he fails to do this, his diet is changed and he increases the content of Vitamin A.

The medical department has compiled complete records of all ailments occurring aboard for the full calendar years of 1948 and 1949 and is right up to date on similar statistics for the calendar year 1950. The results of this study have shown that out of every 100 passengers flown, only one becomes ill, and that is not even in the most comfortable seat, to put it another way, 99 out of every 100 passengers transported enjoyed their trip in perfect comfort.

Research for Future Air Travel

The work by this department is continued to present-day flying; however, as a great deal of research is at present being conducted on what problems may arise in an trend of the future. What effects high altitude flying will have on passengers has been one of the major projects under investigation. Appropriate oxygen equipment has been installed in 41 of the present planes that have been designed so that any passenger may use it who wishes. Experiments conducted by this department show that take them to the high altitude and hold chambers. This equipment has no seal at sea and from it have come some extremely valuable information and data on what may affect people under varying conditions.

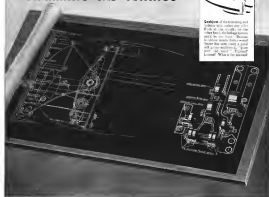
The most important piece of lab

oratory equipment that the medical department has is the flying pressure pit. On the basis of United's safety policy that no new development should be installed in regular planes until it has been thoroughly flight tested, the company revamped one of its Boeing 324-24 transports and turned it over to the airline's communications laboratory to be used exclusively as a research plane.

The plane has the official title "324" and is known throughout the air line by its distinctive coloring. During 1950, over 40 different projects were tested aboard the laboratory, including such valuable pieces of equipment as the portable oxygen analyzer, constant landing system, portable de-icing equipment, fuel and vacuum systems and means for engine detection. Sponsored by the officials of the airline, plane 324 accomplishes two purposes for United: (1) it enables United engineers in the various fields of the company's operations to test experimental projects in actual flight and thus to improve and speed certain technical developments, and (2) it enables United Airlines to give a thorough proving of development of refinements of every project in relation to flight safety before installation is made on standard type transports.

Thus with the newest contribution to United's research department the flying laboratory might well symbolize the thoroughness and forward thinking of the staff of United Airlines in carrying out its program of safe, comfortable and efficient air transportation.

CURE "TRIMMING TAB TETANUS"



Sections of the wing and other parts, which are only 1/16" thick at the middle on the other side being tapered, must be in line. Because of stress during flight, which leaves the wing with a good deal of stress, the wing must be in line. "Trimming Tab Tetanus" is a common ailment.

WHILE THE SHIP IS ON THE DRAWING BOARDS!

The answer is given at the blue part above—drawing Fafnir installation in the Curtiss-Wright 20. Learn Fafnir at the point of failure—right on the sketch. And it's a logical answer, too, for trimming and balance and safe with Fafnir in every link of your control system—on the bearings that are "test-hopped" before flight" by over a hundred minutes Fafnir inspections which prove them right. Learn "Fafnir" at the right spot on your job as suggested to make flying easier. And only Golebski could advise.



It costs only a little more to make flying easy



FAFNIR

Ball Bearings

FOR AIRCRAFT ENGINES AND CONTROLS



In the cold chamber, new equipment is tested at low temperatures associated with high altitudes.

Malliner Maintenance

(Continued from page 37)

"Plane Overhaul," is the masterpiece, and every mechanic knows what his particular job is to be. "Thus, on these down-run events it is not unusual for the plane. There is no confusion, no lost motion, because an unbelievable amount of work is to be done in the two working days before this ship must be ready for its next scheduled job. A score of workers are going on at the same time, each of which is performed by men accustomed to that particular job.

Inspectors are the key men. They have had at least nine years of experience, but that is a minimum length of service, and men have been working on airplanes for even longer periods. These inspectors take the ship, disassembling the work according to a pre-engineered schedule.

The airplane is raised on power-driven jacks so that the wheels may be removed. The major inspection plates, located at strategic positions throughout the plane, are removed as soon as possible on their hinges. Through many years of experience the airline, working closely with the airplane manufacturers, have learned where trouble in the engine or the wings and fuselage might develop. At these points the skin covering is removable. An inspector, armed with a flashlight and what looks like an enlargement of a doctor's mirror, can examine these critical internal points.

And they don't miss a thing!

These inspectors are the diagnosticians of their profession. They pick and point around the airplane the way your physician does around you when you go in for your periodic check-up. They even have a microscope to get the first of the wing ribs where there are no suspension openings. Trust, it isn't the delicate microscope your physician uses on your chest but it works as effectively for its purpose. It is a small section cap on the end of a handle. As an inspector passes it against the outer side of a wing rib, he can tell from the feel and the sound if the rib is in a strong, healthy condition.

A large inspection is an extremely complex mechanism. It contains literally miles of electric wiring, control cables, and plumbing that carries gasoline, oil, hot water for heating the cabin, and hydraulic fluids for operating mechanisms, flaps, landing gear and brakes. There are valves, pumps, switches and controls, by the score, to say nothing of the two great engines and all their accessories, which we'll talk about later. At the time of this check-over, Malliner's inspectors deliver a few elaborate fluids, tightening operating parts, checking connections and fittings, and testing pumps, valves, switches and all movable parts.

Inspectors carry clip boards on which are normal inspection forms listing parts of the airplane to be removed to the check. Most very rare parts that the mechanics to do specified work. Before a plane is given a final O.K. more than 300 items will have been checked.

In the interior of the ship the carpet that runs down the center aisle is removed and the floor boards taken up, permitting an inspection to examine cables and wiring that run through the belly of the airplane. In deeper places the movable seats and all various items are removed and are stacked on a rack in a close inspection. Any fabric that is damaged goes to the upholstery shop. The inspection begins at the wheelers in the rear and by the time he gets up to the nose, every inch of the interior will have been examined.

Up in the main compartment, just aft of the pilot's cabin, experts from the radio department are inspecting equipment which they take to the radio shop for testing. In this cockpit the two pilot's seats are removed to give more work space. Half the instruments are removed and sent to the instrument shop for testing, and the balance are tested in the airplane. The complicated hydraulic system, the electrical communications and variables, de-ice equipment, cabin heaters and dozens of mechanical gauges, are carefully checked.

While this is going on the engine-chests never lose a beat. Working in two groups, one for each engine, they have removed the cowling and seal it off in the cleaning room. Then propellers are given off, the variety of pipes and electrical accessories that surround the engines are disconnected and by means of an overhead hoist and a mounted the engines are lifted from the ship and moved off on one side where exhaustors, magnets and other accessories are removed. Engines are then transferred to portable engine stands and towed into the engine shop where they are so completely dismantled their own master wouldn't know them.

And that brings us to the subject of the special shops—which tend to make Malliner's base unique. There is a variety of special equipment in these shops that exist at no other airline base. The shop divisions are as follows: engine, propeller, accessories, instruments, radio and electrical equipment, machine shop and heavy. In each of these shops are specialists in their particular kind of work. In fact, in each shop there are super-specialists who concentrate on one phase of the work.

In the engine shops the great Pratt & Whitney are completely dismantled each 500 hours, even though they have not even as a spring test every month since their last overhaul. Every bolt and nut is removed and the hundreds of parts are put in strict order on a multi-shelf track and stowed in the cleaning department where they are cleaned and passed on for inspection. Shop parts are then dispatched, which is a regular pro-



Along the line from front to rear, B-29 bomber and field men keep the B-29 bomber moving on schedule.

BENDIX

BENDIX RADIO

RADIO NEWS

SEPTEMBER 1946

Published by BENDIX RADIO CORPORATION, Bloomington, Ind.

Circle Address REVELAD

UNITED AIR LINES ORDER NEW BENDIX AUTOMATIC COMPASS FOR ALL SHIPS



United Air Lines B-29 bomber, the only four-engine plane in the world, will be equipped with Bendix Automatic Compass for all ships. The compass is a new Bendix Automatic Compass for all ships. The compass is a new Bendix Automatic Compass for all ships. The compass is a new Bendix Automatic Compass for all ships.

Orders Placed after Extensive Flight Research Proves Reliability of the New Bendix Automatic Radio Compass



Approved the Bendix Automatic Compass. (Left to Right) Major, Major, and Major of the United States Army. The compass is a new Bendix Automatic Compass for all ships. The compass is a new Bendix Automatic Compass for all ships. The compass is a new Bendix Automatic Compass for all ships.



Flash!!! National Airlines and Trans-Canada also choose Bendix Automatic Compasses for their new Loaders!



Flash!!! National Airlines and Trans-Canada also choose Bendix Automatic Compasses for their new Loaders!

FLASH!!!

National Airlines and Trans-Canada also choose Bendix Automatic Compasses for their new Loaders!

BENDIX—STANDARD FOR THE AVIATION INDUSTRY

UNITED CELEBRATES THE 20th



At dawn, September 8, 1920, the first coast-to-coast air mail flight took off from Hazelhurst Field, Mineola, Long Island. The small, single-engined plane had few instruments. Its pilot had no communication with the ground. And he flew only during daylight hours. Three days later Flight 1 reached San Francisco.

Twenty years later, to the day—September 8, 1940—United Air Lines' famous "Continental" will take off from La Guardia Field at 5:30 p.m. to fly to California, enroute, following the same route from New York, via Cleveland, Chicago and Omaha to the Pacific.

The big Mainliner sleeper scheduled on coast-to-coast Flight 47,844, will be manned by a crew

of two pilots and a stewardess. At their disposal is every modern airplane and airway facility. Passengers aboard will enjoy luxurious accommodations. And the next morning they will step out in San Francisco, at 8:04 a.m., after a restful night's sleep in a berth or big as a rock bed. Their fare is less than \$150—compared with the \$900 charged the first trans-continental passengers.

ANNIVERSARY

of the MAIN LINE AIRWAY



Thus, this month, United's Main Line Airway marks its Twentieth Anniversary. Flight 47,844 reflects the result of the great pioneering of the U. S. Post Office Department, followed by the engineering progress achieved during United Air Lines' world record experience of 175,000,000 miles of flying.

United's Main Line Airway parallels the Old Overland Trail, historic route of the explorers of the West, the covered wagon, the stage coach, the Pony Express, the first trans-continental railroad, telegraph and highway.



On this original cross-continental airway were developed most of the outstanding service features of airline travel, as well as the important scientific achievements that make possible modern airway service.



For twenty years this airway has ranked as the world's busiest long distance air route. Today, great fleets of Mainliners span its length over-night, to provide you swift, dependable, economical air transportation between the most important cities of the East, the Middle West and the entire Pacific Coast.

UNITED AIR LINES

COAST-TO-COAST . . . THE MAIN LINE AIRWAY





The twenty-year history of the Main Line Airway is a brilliant record of transition from daring adventure to daily acceptance by the American public. Each year since United Air Lines started commercial opera-

tion on this route in 1927, it has fostered this acceptance by a program of finer and finer equipment and service. Contributing to this program, Sperry gyroscopic instruments for navigation and flight control have become a familiar sight in the cockpits of every airplane on the "Main Line"

SPERRY GYROSCOPE COMPANY, Inc.
BROOKLYN, N.Y.

E. T. Rugg, Director of Flying, United Air Lines, with a 20-year record in Commercial Flying, says:



"We will need sixty to eighty co-pilots per year for the next four years..."

"We get our flying personnel from such Government-approved schools as the Boeing School of Aeronautics and from the Army and Navy..."

"In the past year we have hired 20 graduates of Boeing School of Aeronautics as co-pilots—would have hired more, had there been more graduates available..."

THESE straight-from-the-shoulder statements by the Director of Flying for the great United Air Lines point to the growing need for fliers trained in this modern, approved school of aeronautics.

If you want a career (not just a "job") in the growing, modern industry, note these vital facts about Boeing School:

1. The only school that is owned by a major airline and U. S. Government-approved in flying, mechanics and in a regular school.
2. Many instructors to guide and inspire you in your studies...for more individual attention.
3. Offers several courses (24 subjects) from which to choose.
4. Instruction modern, sharp and intensive.
5. Six different careers, numerous types of training planes.
6. Located right on the BBO-acre Collierville, Calif., Algonquin makes you not even need to study the man whom you are training in July.
7. All-year flying weather.
8. Founded and operated by United Air Lines, the world's most experienced Air Transport organization.

Full credit is allowed for flight instruction sponsored by the Civil Aeronautics Board.

Boeing School admits only men who are fit to fly and to the most advanced



BY CAREER COURSES: The specially designed 16 to 24 courses built for you. Choose the one you want. Check the "yes" or "no" on the right.

- | | |
|---|--|
| <ul style="list-style-type: none"> 1. Basic Pilot and Navigator 2. Basic Pilot and Navigator 3. Basic Pilot and Navigator 4. Basic Pilot and Navigator 5. Basic Pilot and Navigator 6. Basic Pilot and Navigator 7. Basic Pilot and Navigator 8. Basic Pilot and Navigator 9. Basic Pilot and Navigator 10. Basic Pilot and Navigator 11. Basic Pilot and Navigator 12. Basic Pilot and Navigator 13. Basic Pilot and Navigator 14. Basic Pilot and Navigator 15. Basic Pilot and Navigator 16. Basic Pilot and Navigator | <ul style="list-style-type: none"> 17. Basic Pilot and Navigator 18. Basic Pilot and Navigator 19. Basic Pilot and Navigator 20. Basic Pilot and Navigator 21. Basic Pilot and Navigator 22. Basic Pilot and Navigator 23. Basic Pilot and Navigator 24. Basic Pilot and Navigator 25. Basic Pilot and Navigator 26. Basic Pilot and Navigator 27. Basic Pilot and Navigator 28. Basic Pilot and Navigator 29. Basic Pilot and Navigator 30. Basic Pilot and Navigator 31. Basic Pilot and Navigator 32. Basic Pilot and Navigator |
|---|--|

Boeing School of Aeronautics, 16000 N. 1st, Algonquin, Illinois 60015. For more information, write to the Boeing School of Aeronautics, 16000 N. 1st, Algonquin, Illinois 60015.

Name _____
Address _____
City _____
State _____
Zip _____
Phone (include area) _____

BOEING SCHOOL OF AERONAUTICS A DIVISION OF UNITED AIR LINES

ons for discovering flaws that may have developed.

During the inspection, parts are inspected, then assembled in a circulating bath containing metal filings, dust, examined by microscope and magnifying glasses. A minute surface crack, or even a flaw beneath the surface, will attract the metal powder in the bath as the files in a thick line. A skilled Magnaflo man knows just where to look for possible trouble, and he throws out any part which is not perfect. Only parts which pass this super-critical test are approved for further use. Non-ferrous parts which cannot be inspected are given external visual inspection under strong lights. After its rapid inspection, the engine is laboriously built up again, part by part. When complete it is sent to the engine test room where it is run for 4 hours, while a careful check is made

and pumps are cleaned, they are re-mounted with test devices that simulate actual operation in the air. The grinding instrument gives its spark plugs in typical. Plugs for high-powered aircraft engines are only direct contact of the user in some assemblies. Two conditions are present in an aircraft engine which would intensify wear on your automobile spark plugs in a few minutes: great heat and great pressure. So when United's mechanics have taken the plugs apart, cleaned and inspected them, the parts are assembled, the plugs are checked for the first adjustment necessary, and the plug screwed into its test chamber. Thus the plug is good under even greater pressure than is exerted in the cylinder. Sensitive instruments record the plug's performance, and a plug that passes the test will continue to deliver perfect service 4,000 other kinds of accessories

grindings, 8 wheelers, valves, 2 rotor levers, a shifter, 2 milling machines, 1 two-spindle drill press and 1 large machine, 2 large drill presses, 1 drill grinder, a shaping saw, and there is a new metal drill seen to be received. The shop also has an 18 x 18 x 40 climatic chamber for testing. It is used with automatic controls, an electric air bath, electric oil spraying, and a 4-wheel hydraulic test. A good share of these machines are brand new, and they are not just for show purposes, either. The man can make anything that is on a blueprint, and store that in his shop.

Down the line from the machine shop is the structural shop, where an exact amount of valuable work is turned out. The two departments share away all day long, incidents are busy at both steel and aluminum welding, and error in the placing from hundreds of parts are being given special tasks to protect them from corrosion. Wing mounts and tanks are rebuilt, stainless steel exhaust collector rings and valve rods are made, valve testing units are fabricated and a variety of parts and fittings are made.

When the Boeing factory discontinued making its famous 240 Model, of which some 36 are now in service, it moved out of its plant and into the Chrysler base of United Air Lines. New United makes parts for its own 15 Boeings, and for the other 36 that are scattered throughout this country and South America.

In the stockroom at Chrysler hundreds of different parts are kept which have been bought outside, made in the shop, or constructed. One machine overhaul as these parts are needed, they are taken from stock and installed in airplanes. An airplane being given the 40-hour check requires 150 to 180 parts for 48 hours, or two working days. The first half-day is spent in removing all equipment which is to go to the shops, removing body plating and opening inspection plates, making inspections and in getting the exterior cleaning started. Inspections and some corrections are made each period, and on the next day inspection and inspection parts flow back into the airplane. Fresh engines are installed and dismantled, propellers are put in place, instruments and radio equipment are installed, flooring is put down in the cabin, lavatory bathroom and chair corner put in place and the entire cabin goes over with a vacuum cleaner, and the many items provided for passengers are installed. In the meantime the cleaners have finished polishing the interior of the ship, and it glitters like new again. Any mistakes on the painted exterior are removed. Windows are cleaned. All items checked



LEADING AIRCRAFT MERCHANTS SELECT HOWARD

It is significant that several leading Aircraft Merchants in the Eastern States have selected the Howard 5 place Personal Transport to offer to their discriminating clientele. These merchants have long specialized on this category of airplane and their judgment of value and performance is usually considered final.

Experienced airplane owners in these Atlantic Coast states know Inter-City Airlines, Inc., Municipal Airport, Boston, Massachusetts, Seaboard Aircraft Sales on Roosevelt Field, Long Island, New York, Wings Field, Inc., of Ashler, Pennsylvania, and Air Service, Inc., of New Castle, Delaware, as they provide an aircraft service of high caliber.

Ask any of these merchants for a demonstration in a new Howard and write for a free copy of the Aircraft, describing the top 5 place airplane of the year.

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The size of the 240 Record model is inaccurately presented in the illustration. It can be put just four days today.



An example of a specialized shop at Chrysler in this instrument shop, where all types of aircraft instruments are inspected, tested, and remounted before being sent back into a plane.

at its operation. If it meets, the high standards set by United Airlines, it is approved and sent through to the repair-shop shop in the large hangar, where it will be ready for installation. Even then, it must be run there before it is finally approved for service.

In other shops, propellers, carburetors, magnets, pump rods, instruments and batteries are put through grinding tests and completely rebuilt if necessary. In the shop the shop is, "Test-and-test" Every part that can be tested is tested, and usually the tests are more rigorous than under operating conditions in the airplane. All up and down the line, from inspection to mechanics, United's men have down an amazing longevity in designing and building test equipment.

In the accessory shop, for example, there are test benches running around all four sides of the room. After accessories such as carburetors, magnets

running from propellers to automatic mixture controls are put through their paces. When the final test is the equipment run, O.K., the mechanic don't worry about the part falling in flight.

Nearly all of this test equipment, and in the other shops, was built by United's own machine shop. Not only has the machine shop saved thousands of dollars in the price of new equipment, but a large share of the output has been specially designed and could not be bought elsewhere. Equipment built in the machine shop includes an hydraulically operated test for removing the large test in a Douglas, a machine for lifting piston rings, a brake drum grinder, several hydraulic test benches, power units for raising the D.C. and many other special tools, jigs and test equipment.

There are 20 men in the machine shop and their facilities include 4



A boy and an engine grow up

No more rubber band models for him! He's graduated to a gasoline motor — his first taste of real power.

But in just a while he will be searching for greater and greater power. He will follow in the footsteps of the aviation engineers who are constantly striving to surpass today's performance, to make planes fly farther and faster.

For aviation progress depends to a large degree on power. And since increased power must come through

refinements in fuels and engines, the engineers of the Edsall Gasoline Corporation are privileged to work in close cooperation with aviation technicians.

Already this program of continuous research has developed a file of useful data. Much of this information is of practical value today, but there is a great deal more that will be of greatest use in years to come — the years when young lads like the one in the picture are ready to take their places in aviation.

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by the inspectors for repair or replacement have been increased.

Now comes another round of inspections. Each of the three inspectors goes out for a flight check in which he directed that certain work be done. Then he makes sure the work was actually done. There isn't once in a hundred times that the confusion stops up, but the inspectors take no chances. When the inspectors say the word, the ship goes out for as long as ten hours with a pilot who is critical of every detail of the airplane's performance. Every instrument, every control is checked and established to make sure it functions properly. Only when the test

overhead described above, but the night overhead includes all these points and many others.

At the time of the "major" not only are engines, wheels and some of the instruments removed, but entire wings are unbolled. All inspection plates are opened as well as additional photographs removed along the entire length of the wing. The huge gas tanks make are taken out and sent to the sheetmetal shop where they are cleaned by steam and tested under pressure. Every rivet is such thing is examined, and if one shows the slightest signs of wear it is replaced. Ribs and spars are thoroughly checked. Not a piece is

been lefty removed by mechanics and taken back to the shops for cleaning, inspection and testing. While a 600-hour inspection requires two days, the 1000-hour check takes a larger crew of mechanics—four or five days. Not thirty hours, no hyper-extended hospital superintendent has ever done such a job of cleaning as these airline mechanics put on. Grease don't bother the boys very much, but the way they look for signs of corrosion, metal fatigue in wire is certainly a common. Nothing escapes them.

Then the part, come flying back into the hangar again and soon a brand new ship is ready for its test flight. It looks as new as it did when it came out of the factory. Actually it is a better airplane than the day it made its first test flight. Like an over-doing steersman, it has had no shake-down cruise. Old airplanes and engines actually require less maintenance than new planes, because they "legs" have been worked out.

This remarkable maintenance program is not something that occurs spontaneously. It goes on day after day in a never ending process. It is why modern transportation does not make a mistake. The airplanes that were the last word in air transport in 1934 are being superseded by the larger Mainlines for reasons of speed, passenger comfort and operating economy, not because the older ships have worn out. Today's maintenance is so thorough that the great ships flying the main line now will still be operating safely for many years to come. At United 1934 performance maintenance that brings perfection.

After one has studied the maintenance system that keeps these great transports in the air, he realizes that the true secret of United's success lies in its men. Any business can develop a system, but the degree of its success depends upon the men behind it.

Since its inception, United Air Lines has carried out these aims, chosen its men carefully, trained them well, and encouraged them in their work. Many years ago it organized the Boeing plant, and has since then, through its own initiative, helped the Boeing plant to develop its own maintenance school so that it need not be for the airline, but many do. At present, United is using the school to give flight attendants the same type of maintenance training. In addition, many Boeing graduates who are specialists in mechanical work are employed by United.

A second phase of training is carried out in the Cyprien shops, where apprentice methods are used to train men for both the overhead work and for maintenance work along the route.

Pilots, dispatchers, radio operators, stewards—almost all career interest trainings. And all employees reflect their training in their splendid work.



When a fully loaded Douglas rolls in for a landing a great strain is put upon the landing wheel brakes. United's maintenance department is glad to take down its DC-3's.

plant has added the "DB" to the long list of approvals is the Mainline ready for flight.

This 600-hour check is thorough, but it is only part of the maintenance story. At the end of every trip mechanics who have insured their trade at the Cyprien shop go over the plane. They have reports filed out by the captain and the first officer, as well as by the stewardess. Any operating part of the airplane that has been over a half's breakable use of time is repaired and is fixed before the ship goes out on its next run.

As such 600 hours roll around, the airplane is rolled back in Cyprien for final inspection and all the inspections and testings that make up the plane overhead. After about seven plane overheads comes the major overhaul. This occurs at every 5,000 hours and is what the mechanics call "the work". It is hard to imagine an inspection which is more thorough than the plane

being in used. There is no chance that may have been done by a man pulled up in his office and a new one installed in place.

All the control surfaces are removed. Afters, radials, elevators, stabilizers and the fin are taken down the airplane. There is much labor involved here, but the labor removed and after inspection and perhaps some cut parts, new fabric is used in place.

The interior of the fuselage looks as though it were entirely new, but it is not. Every rivet of the comfortable cabin which the passenger sees has disappeared. Seats are removed first, then curtains, lighting fixtures, ventilators, the window shade wells, sound proofing, and an on and on until only the bare shell of the airplane is left. Wiring, valves, plumbing, and all possible parts are suddenly taken out.

Up to the point where the fuselage has returned to its way. Not a replacement, switch or control but what has



A Battle Cruiser takes off . . .

BY LES E. FRANK

To the Navy it was a relatively modest ship . . . a patrol plane sitting off on a remote water order.

But not . . . it was an anti-submarine night . . . a powerful battle cruiser breaking the traditional shackles of the Navy and creating a new medium of defense in control of our country's movements.

The game being hour round . . . the waters showed their challenge . . . the hour moved faster and faster. Calling upon it to be on the water . . . the wheel of time instead of national rhythm . . . and it sped suddenly the road of white sand . . . it was in the air.

Yes . . . in the air . . . a game measured in game time had left the water as smoothly and as effectively as it was followed by the ship as it flew. It was a magnificent sight . . . and a magnificent sea.

For while that ball was moving to protect the ship, happiness and peace of our country and our people.

Now a speck in the sky above the horizon, the plane is on its mission . . . flying the gap between our Navy's two bases in their defense of our farthest outpost. An eagle eye of the Navy . . . with the Eagle's striking power against air and surface with ready when the occasion demands.

In 16 hours it may be back . . . having covered its entire patrol thousand miles. Or it may not be back for a week on a month. It may make its way back home . . . or may come only months later for the night. To be on its way again in the morning to guard our ships and Navy . . . and operate with it for days or weeks. Its operations of its mission . . . it will accomplish it with dispatch and efficiency.

It is hardly a humble opinion of the new . . . with complete accommodations for its crew . . . capable of operating over tremendous ranges . . . from ships or ship bases. A star is not a star . . . it's a craft that new Navy's PBM-3 . . . all on a mission . . . it is the new Navy's.

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Mechanics' Training

(Continued from page 36)

hons of dollars was not, of itself, going to save us. They knew that we needed more than the thousands of new planes which were to be turned in. In order to turn this money into flying equipment, and in order to keep this equipment flying, they knew that we needed thousands of expert aircraft and aircraft engine mechanics in our military services. And all this had to be turned to the private aviation schools, just as they have turned to private flying schools for primary training of our new crop of military pilots.

There is a lesson for the American public in this action as the part of our Army authorities, and the lesson is particularly vital in view of the present urgent demand for a stronger national defense. This is that it is obvious there are some things which a government cannot do for itself, some jobs which even the Army must turn over to private initiative. In spite of the huge investments which our country has made in educational facilities, it is apparent that these facilities are not geared to the task of meeting such an emergency as that which confronts us. This is because our public schools are essentially academic in character. They teach theory, rather than practice. They train people for living, but not for earning a living; they teach them how to enjoy life but not how to defend it. This is not meant as a criticism of institutions in the line with it. It is necessary, in some study of life, to study field hospitals, electronic industries, psychology, logic, and the works of Aristotle, Homer, and Chaucer. But right now it is more important that a great many young men are working about the north of Douglas, Martin, Northrup, etc., than that 'all God is divided in three parts'.

The curriculum of Curtiss-Wright Technical Institute is based on the needs of the American aviation industry. Since these needs are changing rapidly and equally as fast as certain designs and manufacturers change, we change our curriculum without notice as necessary to keep abreast of industry techniques. This is done by constant consultation with aviation industry officials on the part of our staff. Furthermore, our instructors are all drawn from the industry. It is obvious to their students, to the Government and other teaching organizations, we require that all our students must have had a reasonable period of experience

in the aviation industry doing the job that they are required to teach in our school. We have found that men are more important than books and manuals, that ideas are more important than tool-banks.

We teach our trainees to learn by doing. Theory is taught of course, but it is kept subordinate to practice. We stress the provision of actual equipment, engines, parts, tools, etc., that the mechanic will be working with after his employment in the military begins. So successful has this type of instruction proved that our articles connect correspondingly with new records.

In August, 1939, we had 600 civilian students of all classes. In April, 1940, we had 1,000 students, and today we have more than 1,200 civilian students alone under instruction. About 50 percent of these men are taking the master mechanic course and about 40 percent are studying aeronautical engineering. Our paid staff of instructors and employees has now reached a total of over 150 persons, and our total floor space covers 180,000 sq. ft. By any comparison standards this would make a pretty good sized aircraft factory.

Our curriculum has been stripped of all non-essentials in order to produce the maximum result in a minimum time. As a result we are able to train aeronautical engineers in 30 working weeks, master aviation mechanics in 48 weeks, and engine or airplane specialists in 32 weeks. Only the most careful organization, supervision, and coordination, perfected by long experience, makes it possible to give adequate training in so short a time.

It is apparent evidence of how well our system of instruction is organized that we were able to undertake the Army Air Corps mechanic training program in only 45 days after it started. During the past year we have trained more than 600 Army men, and our new contract calls for the instruction of even that 1,200 military mechanics during the next twelve months. Our total enrollment is now approaching the 2,000 mark. Yet these hundreds of civilian and military students work side by side in perfect harmony and with comfortable efficiency.

The end instruction is different in many ways due to the fact that certain mechanics must have a general knowledge of the whole brand field of aviation, while the military students' training is more strictly in military types of equipment. For this reason it is possible to train the Army mechanic in 568 hours, whereas the civilian master mechanic course requires 1,008 hours.

In aviation work there is no longer any doubt that sound, basic training pays big dividends.

Slim

(Continued from page 37)

normal planes. Local designers and manufacturers have been trying out designs and making a number of tests experiments.

Turning to Slim's commercial aviation, we find its importance growing rapidly not only in air as local air transport is increased, but also in respect to international traffic. For example, Imperial Airways (British), Air France (French) and K.L.M. (Dutch) operate a route of five through services each way weekly. British, Imperial Airways operates twice a week in each direction between Bangkok and Hong Kong, while Air-France implements its service between Paris and Bangkok with a weekly service between Bangkok and Saigon.

Within the kingdom area of the air transport is operated by the Aerial Transport Company of Thailand which carries air mail to the various provinces. Air distances within Siam is covered by air mail at least twice a week.

During a typical year ending March 31, 1939, the company's costs amounted to 14,192,000 bahts (\$3,943,866) of air mail, 7,144 bahts (\$1,892) of fuel, and incurred 155,542 kilometers (96,531 miles). Passengers are carried only when the amount of cargo permits it.

During the typical year of 1939 there was not a single accident with a loss of life or injury or serious damage to any aircraft, or damage to any of Thailand's airports.

The Aerial Transport Company had scheduled a total of 200 north and south-bound flights, all completed without a single forced landing or the slightest damage to equipment. In all, 1,321 flights were recorded that year.

All these commercial aviation activities are supervised by the Civil Aviation Division of the Ministry of Revenue Affairs. However, the law regulating aerial navigation is administered by the Ministry of Defense.

The Civil Aviation Division is carrying out a long-range program of modern aviation development. In addition to increasing regular scheduled air services, active airports and emergency landing fields along all airways. The regular airlines are provided with accurate forecasts, fireproof hangars, elaborate terminal buildings.

A network of air terminal stations, all with D/F apparatus and forecasting on both standard and short wave frequencies, covers the whole nation. Ready up to the minute use the equipment and services of the meteorological division.



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Research for Defense

(Continued from page 95)

use of degree of intensity rather than any shift in direction. This is as true for research as it is for industry generally. It is now plain that all such efforts have been being chiefly toward the development of materials and machines for the fighting forces rather than the creation of higher standards of living for the people.

Whether we like it or not, our research must shift its goal of view to meet this situation. Where we have been accustomed to thinking in terms of bettering our products for personal improvement is our standards of living, we must now begin to put efforts toward efficiency for war, for destruction rather than for constructive effort. Our laboratories must begin to concern itself with better armor, glass for bomb sights and for night-vision rather than for better glass for better houses and safer glass for safer automobiles. For the time being our chemists may have to spend some cheaper and better materials for paper and more industrial fabrics for the world of fashion, and just some of these efforts on more efficient fuels for fighting aircraft, or more efficient lethal gases. Our aerodynamicists and our airplane designers must put on the shelves their new designs for airliners, and more comfortable airplanes for our domestic and overseas passenger and must bend every effort toward producing airliners that are sturdy, faster, larger and more efficient bombers.

Now that the issue has been clearly defined, what are we doing about it? True in addition, although we have been slow to recognize the existence of our emergency, now that we face the issue we are preparing to make use of all available physical and social resources without waste. Recognizing the vast research potential of the country, unified and coordinated for purposes of national defense, President Roosevelt, on June 15, 1940, created the National Defense Research Committee. This committee acts directly under the council of National Defense—acting including the Secretaries of War, Navy, Interior, Agriculture, Commerce, and Labor. The functions of the Research Committee—issuing from the Presidential order of June 27, 1940—are to coordinate and support scientific research on the mechanisms and devices of warfare, except those relating to problems of flight included in the field of activities of the National Advisory Committee for Aeronautics. It shall aid and supplement the experimental and research activities

in the War and Navy Departments and may conduct research for the creation and improvement of instruments, methods and materials of warfare.

Here, then, is research in flexible warlike guise—here is the authority for action to begin the immediate task of leading its developments into a road in the execution of the moment there is, however, one thing that we must watch carefully. Not all of our plane designs can be devoted to the hope of Valparaiso. We are not yet involved in total war. Our present purpose is only to build up our defenses to keep us safe from our planes. For the time being, decisions only a part of our research capacity should properly be devoted to military purposes. Some of it, chiefly in the military applications laboratory, some in only limited applications and some has immediate use. It is important, however, to evaluate our capacity for research projects in our only what we need for the present limited emergency without losing sight in long-range fundamental problems that will be with us many years after the war is only a matter of history. It is definitely a part of the new Research Committee's responsibility to coordinate and to plan our research effort properly so that research that is essential to our economic and social future is not completely dropped or set aside during this emergency military attack.

(To Be Continued)

Junkers Jumo

(Continued from page 95)

Merlin in Great Britain. The Germans claim their engines provide better velocity for single-engine planes and are easier to build and service in the field. It might be well worth while for us to investigate the possibilities of the inverted, low-type, high-powered aircraft engine before committing ourselves to the mass production of new quantities of high-performance liquid-cooled engines of a type which have been discarded in Germany.

Specifications

Junkers Jumo 211 aircraft engine. Type: twelve cylinder, water-cooled, air-cooled, low speed drive, four cycle. Bore and stroke: 5.9x5.6 in. (Displacement): 2,338 cu in. Length and width: 89 in. x 69 in. (Weight): 1,260 lb. at 6,000 r.p.m. 1,300 lb. at 6,400 r.p.m. 1,390 lb. for take-off. Total weight (dry): 1,290 lb. Fuel consumption: 64.5 lb./hr./hp. Oil consumption: 6.60 lb./hr./hp. Compression ratio: 6.5:1.

German Warplanes

(Continued from page 95)

to be taken in the following month by Messerschmitt Me 408 with a speed of 480.0 m.p.h. which is the greatest high speed record. The latest Messerschmitt product is the two-engine Me 410 two-seater fighter which has a speed of 380 m.p.h. at high altitudes and sufficient flight range to accompany.

A visit to the Dornier factories at Friedrichshafen on the shores of Lake Constance proved particularly interesting as both flying boats and land planes were being turned out in appreciable quantities. The flying boats were mostly Do 24 three-engine patrol planes having a speed of 250 m.p.h. and a flight range of 2,200 miles. Unlike the headquarters of Consolidated PBY two-engine patrol planes built for the United States Navy, these German planes are equipped with retractable tail gun turrets and do not have any blind gun armor. These safety factors in the event of failure of one engine in 66 2/3 percent compared with only 50 percent for our two-engine flying boats.

Landplane production in the Dornier factories was found to be confined to Do 17 and Do 215 two-engine bombers having a speed in excess of 300 m.p.h. and a ceiling of 30,000 ft. Some of them were powered with B.M.W. 132 air-cooled radials and others with Mercedes-Benz DB 601 engines.

Practically all the observation planes built by Dornier which are ready in the largest locomotive firm in Europe. In appearance the Heinkel He 125 is similar to the high-wing Dornier observation plane used in the United States. The German planes are powered with B.M.W. 132 air-cooled radials and have a maximum speed of 225 m.p.h.

Junkers have the unique distinction of building gasoline and diesel engines as well as airplanes in a dense or more large factory. The enterprise in production consists of the Ju 87 dive-bomber (Stuka), the Ju 88 two-engine high-speed bomber, the Ju 89 three-engine heavy bomber and the Ju 53 three-engine transport plane. In addition, numerous Ju 86-K two-engine long-range bombers powered with diesel have been produced for the Air Force. The workers spend several days in the Junkers factories to see how airplanes and their engines are produced by the largest aircraft firm in the world.

Part II of this article describing the Junkers aircraft factories will appear in an early issue of Aviation.



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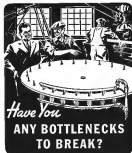
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The entire frame of the Sunotype is a die casting of DOWMETAL[®]—the trade name of a series of magnesium alloys developed by Dow. Thus exceptional lightness is secured and a casting that is durable as well as accurate in spite of the thinness of the walls.

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The Sunotype product of The Sunotype Company, Chicago, includes both lightness and ruggedness by using a DOW MEGAL die casting for its frame.

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1. Eclipse types 571 and 572 Five Port De-Icer Distributing Valves with integral control switch are designed to distribute air under pressure to the inflatable elements of Goodrich Wing and Tail Surface De-Icers. The design of the control switch is such that only one operation is required to direct the flow of air to the distributor valve and simultaneously close the motor circuit, thereby eliminating the need for a separately mounted control switch and valve.



2. Eclipse Type 577 Four-Way Control Valves are designed to provide remote control of Ten Port De-Icer Distributing Valves by simultaneously directing the flow of air to the distributing valve and closing the circuit to the electric driving motor.



3. Eclipse Types 566 and 567 Propeller Anti-Icer Pump Rheostats are available for remotely controlling the output of Propeller Anti-Icer Pumps and are normally furnished in a shielded case for instrument panel mounting.

4. Eclipse Types 573 and 574 Ten-Port De-Icer Distributing Valves are designed for installation in large, multi-engine aircraft to distribute air under pressure to the inflatable elements of Goodrich Wing and Tail Surface De-Icers. An Eclipse Type 577 Four-Way Control Valve is required for use in conjunction with these units.



5. Eclipse Type 568 Propeller Anti-Icer Pumps are designed to deliver a metered supply of alcohol-glycerine solution to the propellers of twin engine installations by means of slinger rings located on the propeller hubs. If desired the units may be used for single engine installations or to prevent ice formation in the carburetor venturi.



NOTE: In addition to the above items of equipment, Pressure Type Oil Separators and Pressure Relieve Valves are available for controlling the pressure in the De-Icer cells.